WSDOT WETLAND MITIGATION SITES

NORTHWEST REGION
MONITORING REPORT

Monitoring Staff:

Fred Bergdolt
Paul Dreisbach
Jim Lynch
Cyndie Prehmus
Bob Thomas
Hilton Turnbull

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Washington State Department of Transportation

Environmental Affairs Office

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INTRODUCTION

History

The Washington State Department of Transportation (WSDOT) facilitates responsible implementation of transportation services, in part by providing leadership to foster environmental stewardship. WSDOT strictly adheres to all applicable federal, state and local environmental regulations, including the Clean Water Act and the state "no net loss" policy for wetlands (Executive Order 1989).

Infrastructure improvements have accompanied economic and population growth in the state of Washington. WSDOT routinely evaluates the potential for degradation of critical areas resulting from infrastructure improvements. Generally, mitigation sites are planned when transportation improvement projects affect critical areas. Monitoring provides a means to track the status and development of these mitigation sites. These sites are monitored by the WSDOT Wetland Monitoring Program. Beginning with six sites in 1988, the number of sites monitored annually has grown steadily. Fifty-one sites were monitored in 2000 (Figures 1 and 2).

Purpose

The purpose for this document is to report the status of WSDOT mitigation sites as observed in 2000. Permit compliance and the development of wetland characteristics are addressed as appropriate. We rely on feedback from the users of this report to ensure its contents are clear, concise and meaningful.

Process

Site monitoring typically begins in the first spring after the site is planted. Sites are monitored for the time period designated by the permit or mitigation plan. The monitoring period generally ranges from three to ten years. Monitoring activities may vary depending on site and permit requirements, stage of site development, and other factors.

Data are collected on a variety of site parameters including vegetation, hydrology, and wildlife. Monitoring activities are driven by site-specific success standards detailed in the mitigation plan. Analysis of monitoring data provides information for an evaluation of site development and permit compliance.

Monitoring data has several intended uses, including the following. The monitoring program staff use results from data analysis to communicate issues related to site development and to report compliance to permit success standards to regional staff and permitting agencies. Regional staff uses data provided by the monitoring team to plan appropriate maintenance and remediation activities. Permitting agencies use the data to track and document compliance.

Methods

Methods used for mitigation site monitoring have changed as site requirements and customer needs have evolved. Our historical data collection methods are described in the ***Guide for Wetland Mitigation Project Monitoring*** (Horner and Raedeke 1989). These methods were initially adopted as a standardized set of protocols, with vegetation, hydrology, soil, wildlife and benthic macroinvertebrate data collected on every site, every year.

As the number of sites being actively monitored increased, these standardized protocols have been modified. During this period, program staff began to evaluate monitoring methods used by other groups and agencies. This effort led to a major change in the methods used to monitor WSDOT mitigation sites. The data collection techniques currently in use include standard ecological and biostatistical methods.[1]

There are several important differences between our historical and current monitoring methods. Brief descriptions of these changes follow.

Objective-based monitoring: Instead of routinely collecting data for a wide range of environmental parameters, we presently collect data using a monitoring plan and sampling design developed specifically for that site. The monitoring plan and sampling design address individual requirements such as success standards, site development, invasive species, and other considerations as required.

Adaptive management: Monitoring is a critical component of the adaptive management process, driven by site-specific management objectives that describe a desired condition (Elzinga et al. 1998). Through appropriate sampling design and collection of valid data, monitoring determines if the objectives have been achieved. Monitoring provides the link between objectives and management activities. Without reliable data to accurately identify deficiencies, appropriate corrective management activities cannot be conducted. Alternately, with poor data, unnecessary management may occur.

Statistical rigor: In the analysis of biological data it is common to discover that too few data were collected for reliable conclusions to be drawn (Krebs 1999; Zar 1999). In addition, data must be collected using some type of random sampling procedure (Elzinga 1999). The monitoring program presently uses a variety of tools to remove subjectivity from data collection and to increase the reliability of our results. Our goal is to provide customers with an objective evaluation of site conditions based on valid monitoring data.

[1] New methods combine changes in sampling design with rigorous statistical analysis to more accurately portray vegetative development on mitigation sites. New methods are based on techniques described in Bonham (1989), Elzinga (1998), Krebs (1999), Zar (1999), and other sources.

Success standards: An important element in any mitigation plan is the objectives and success standards (Ossinger 1999). They serve to indicate the desired state or condition of the mitigation site at a given point in time. Some also provide contingencies if a specific condition is met, such as low aerial cover of woody species or exceeding a threshold of invasive species.

Monitoring program staff use the success standards and contingencies as the basis for establishing management objectives for each site. Management objectives are derived directly from the success standards contained in the mitigation plan and/or site permit. In this process, the goals, objectives, and standards for success and site permit are carefully examined to understand the intended site attributes or characteristics. Each management objective contains six required elements; species indicator, location, attribute, action, quantity/status, and time frame (Elzinga 1999). These elements help describe the desired site condition.

Many management objectives require a companion sampling objective. When the management objective identifies a threshold, such as aerial cover or survival rate, the sampling objective includes a confidence level and confidence interval half width.[2] These are noted as (CI = X ± Y), where CI = confidence interval, X = confidence level, and Y = confidence interval half width. For example, should you see an estimated aerial cover of herbaceous species shown as 65% (CI = 0.80 ± 0.20) in a report, this means that we are eighty percent confident that the reported value is within twenty percent of the true value. In this case, our estimated value is sixty-five percent, and we are eighty percent confident the true aerial cover value is between seventy-eight percent and fifty-two percent.

Two examples of how these will appear in the report follow:

From the Mitigation Plan or Permit:

Success Standard
Upland and riparian forested buffer areas should have 50% cover by forested species planted, or be supplemented or replaced by a native naturally colonizing upland forested plant community at 50% or greater cover.

Derived from the Mitigation Plan or Permit:

Management Objective
Achieve 50% aerial cover of forested and scrub-shrub species in the riparian buffer on the SR 18 Issaquah-Hobart mitigation site by 2001.

[2] The confidence level indicates the probability that the confidence interval includes the true value. The confidence interval half width will decrease as the confidence level decreases (Elzinga 1998).

Companion to the Management Objective:

Sampling Objective 2

To be 80% confident the mean aerial cover estimate for forested and shrub species in the riparian buffer is within 20% of the true cover value.

From the Mitigation Plan or Permit:

Contingency Plan

The mitigation plan is designed to use and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic species, which will not be allowed to dominate the site. Noxious weeds will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 5% of the coverage in the wetland is deleterious exotic species.

Derived from the Contingency Plan:

Management Objective

To maintain the combined level of deleterious exotic species at $\leq 5\%$ aerial cover at the Profitt's Point mitigation site in each year of the monitoring period (2000-2005).

Companion to the Management Objective:

Sampling Objective 3

To be 80% confident that the aerial cover estimate for the combined level of deleterious exotic species is within $\pm$ 20% of the true value.

Mitigation plans and permits frequently contain success standards that are not measurable. One example of this is attempting to measure the survival of woody species in the third year of monitoring. Wetlands are highly productive systems that produce substantial biomass. In most cases, planted woody species that have died cannot be reliably located after three years, and usually will have decayed beyond recognition as a planted species. **Success standards that are not measurable or do not apply to the current year's activities do not have management or sampling objectives in this report.**

The management objectives, sampling objectives, and the success standard from which they were derived are in the text of each site report. The complete objectives and success standards from the mitigation plan for that site are in the appendices of each report.

Intensity of Monitoring

Monitoring is conducted primarily for two purposes (Elzinga et al. 1998). One is to detect biologically significant changes in abundance, condition, or population structure. Estimates of aerial cover and survival of plantings are examples of attributes that can be

measured to detect biologically significant change. The other purpose is to understand the effects of management activities on ecosystems or plant communities.

Parameters for monitoring activities are grouped into two levels, qualitative or quantitative, based on the level of effort or intensity of data collection. Qualitative techniques are generally less intensive than quantitative techniques (Elzinga et al. 1998). Qualitative monitoring provides general information such as presence or absence of specific plant species, hydrology indicators, or assessment of site conditions. Also, photographs are generally taken to document current site conditions. A library of site photographs is available in the program office.

Quantitative monitoring provides information on aerial cover, condition, or site characteristics. Random sampling methods are required to produce a statistically credible estimate of a characteristic when only a portion of a site is sampled (Zar 1999). When practical, a total census gives an accurate count of the population rather than an estimate. A variety of methods and tools are used to collect quantitative data, including the line intercept method (Canfield 1941; Bonham 1989), the point intercept method (Bonham 1989; Elzinga et al. 1998), point-intercept devices, point frames, and others. A detailed description of the specific data collection methods used is included in each site report.

The requirements within the permits and mitigation plan can adequately be addressed qualitatively in some years, and in others, quantitative monitoring is appropriate. If there are success standards for this year of the monitoring period, a report follows in this document. In other cases, qualitative monitoring was conducted, and the results communicated internally to the appropriate environmental manager. This feedback allows the site manager to conduct any corrective activities prior to the time that the next success standard will be quantitatively monitored.

Literature Cited

Bonham, C.D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

Canfield, R. H. 1941. Application of the Line Interception Method in Sampling Range Vegetation. J. For. 39:388-394.

Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management Technical Reference 1730-1, BLM/RS/ST-98/005+1730.

Executive Order 89-10. Protection of Wetlands. December 11, 1989.

Horner, R. R. and K. J. Raedeke. 1989. Guide for Wetland Mitigation Project Monitoring - Operational Draft. Prepared for Washington State Transportation Commission, Department of Transportation, Olympia, Washington. WA-RD 195.1.

Krebs, C. J. 1999. Ecological Methodology, 2nd edition. Benjamin/Cummings, New York, NY.

Ossinger, M. 1999. Success Standards for Wetland Mitigation Projects – a Guideline. Washington State Department of Transportation, Environmental Affairs Office.

Zar, J.H. 1999. Biostatistical Analysis, 4th edition. Prentice-Hall, Inc., Upper Saddle River, NJ.

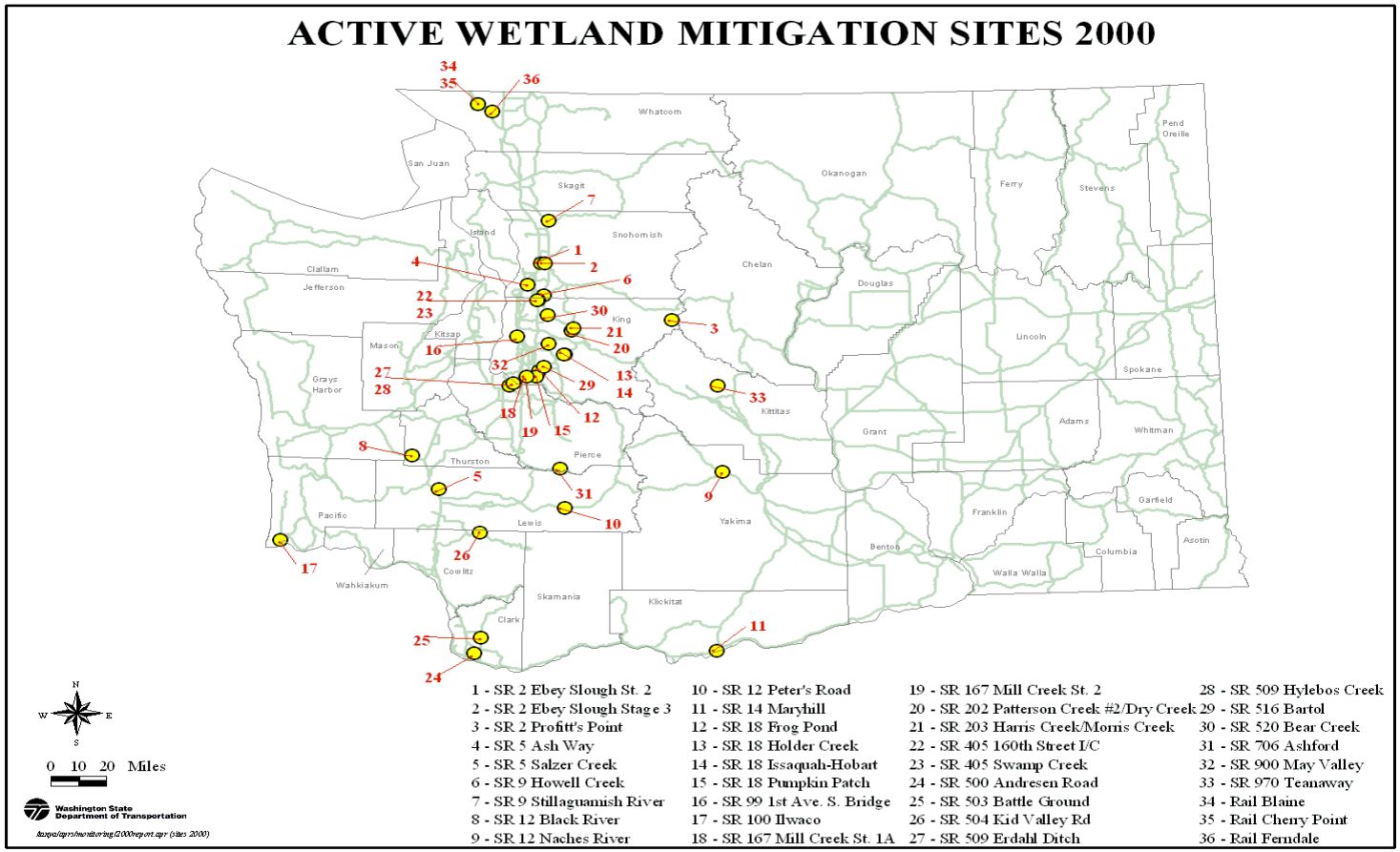

Figure 1: WSDOT Mitigation Sites Monitored in 2000

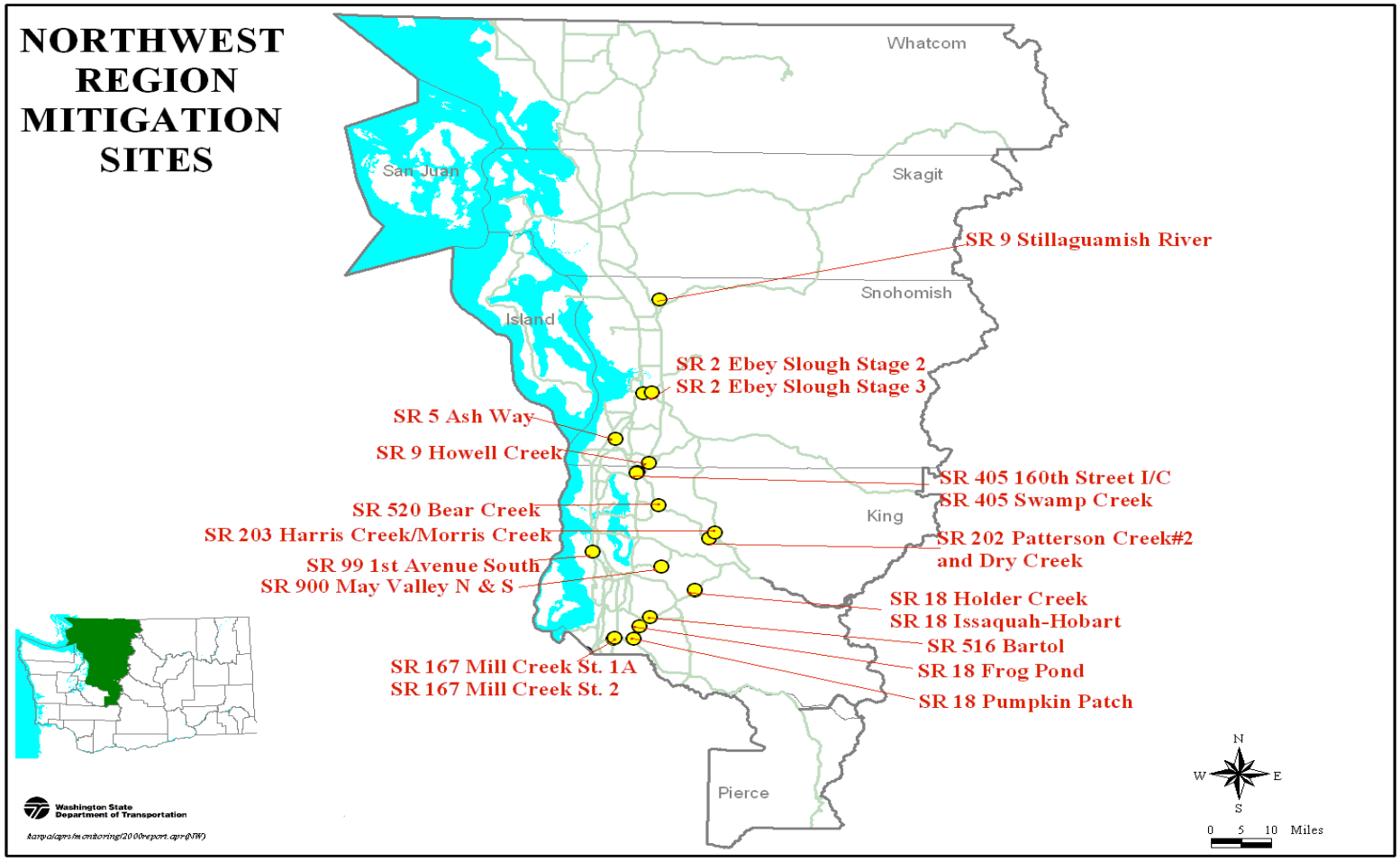

FIGURE 2: Northwest Region Mitigation Sites Monitored in 2000

SR 9 Stillaguamish River, Snohomish County

The following report summarizes project activities completed by the Washington State Department of Transportation (WSDOT) Wetland Monitoring Program at the SR 9 Stillaguamish River wetland mitigation site in July 2000. Monitoring activities include vegetation cover and survival surveys.

Site Information

Site Name	SR 9 Stillaguamish River
Project Name	SR 9 Stillaguamish/Haller Bridge 9/132
Permit Number	97-4-0069
Permitting Agency	USACE
Location	Snohomish County, Washington
Township/Range/Section	T31N R5E S2
Monitoring Period	2000-2004
Year of Monitoring	1 of 5
Area of Project Impact	0.36 ha (0.89 ac)
Type of Mitigation	Wetland creation
Area of Mitigation	0.96 ha (2.73 ac)
Replacement Ratio	1.5:1

Management and Sampling Objective

The monitoring objective for the Stillaguamish River wetland mitigation site was developed from the contingency plan in the *SR 9 Stillaguamish/Haller Bridge 9/132 Replacement Wetland Mitigation Plan* (WSDOT 1997).[1] The complete text of the success standards for this project is listed in Appendix A. Success standards, management objectives, and sampling objectives addressed this year are presented below.

Contingency Plan

The mitigation plan is designed to utilize and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species.

Management Objective

Maintain invasive exotic species at less than 10% aerial cover at the SR 9 Stillaguamish River mitigation site from year 2000 to 2004.

[1] A management objective was not created to address the first year survival standard from the mitigation plan (WSDOT 1997) because a percent survival threshold was not specified. A quantitative assessment of survival was still conducted and described in the methods and results sections.

Sampling Objective

To be 80% confident that the mean aerial cover estimate for invasive exotic species is within 10% of the true cover value.

Methods

A sampling macroplot (165m × 53m) was strategically located to include all vegetation zones at the Stillaguamish River wetland mitigation site. Following a random start, 25 transects were located using systematic random sampling along the baseline at the northwest end of the site. Transects were extended perpendicular to the length of the macroplot and terminated at equal lengths along the southeast site boundary. Both herbaceous cover and woody species survival data were collected along sampling transects.

For the herbaceous community, the point intercept technique (Bonham 1989; Elzinga et al. 1998) was used to collect aerial cover data. Following a random start, point quadrats were systematically placed along sampling transects through all vegetative zones. At each point location, a rod was dropped vertically from above the tallest herbaceous vegetation. All plant species touched by the rod were recorded. If the rod touched no vascular plant species, the data was recorded as bare soil, non-vascular plant, or habitat structure.

Survival data for each planted woody species was obtained from 1-m × 53-m quadrats positioned lengthwise along each of the transects. Individual trees and shrubs were recorded as alive or dead in each quadrat.

The following sample size equation was used to determine the number of sample units required to attain the sampling objective.

$$n = \frac{(z)^2(s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[2]
n = unadjusted sample size

Results and Discussion

Survival data show a combined tree and shrub survival rate of 76% (CI 0.95 ± 0.10) in July 2000. The most commonly occurring species in survival data records were *Salix* sp. (willows), *Thuja plicata* (western red cedar), *Rubus spectabilis* (salmonberry), and *Rosa nutkana* (Nootka rose), all of which were surviving well at the time of monitoring. *Tsuga heterophylla* (western hemlock), *Sambucus racemosa* (red elderberry), and *Rhamnus purshiana* (cascara) had noticeably high rates of mortality or stress and several additional species appeared to be underrepresented on site. Regional staff have been contacted and a remediation plan will be enacted as per the first year success standard in the mitigation

[2] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

plan (Appendix A) (WSDOT 1997). A complete list of species identified on site is provided in Appendix A.

The aerial cover estimate for invasive exotic species in the herbaceous plant community was less than one percent achieving the management objective (Table 1). *Phalaris arundinacea* (reed canarygrass), and *Cirsium vulgare* (bull thistle) were identified on site at very low cover levels.

Table 1. The management objective for invasive exotic species was achieved in 2000.

SR 9 Stillaguamish River	Invasive Exotic Species (Objective 1)
Monitoring Results	<1 % aerial cover
Required Cover	<10% aerial cover

Literature Cited

Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

Canfield, R. H. 1941. Application of the Line Intercept Method in Sampling Range Vegetation. J. For. 39:388-394.

Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management Technical Reference 1730-1, BLM/RS/ST-98/005+1730.

United States Army Corps of Engineers. 1998. Department of the Army Permit. Number 97-4-00669.

Washington State Department of Transportation. 1997. SR 9 Stillaguamish/Haller Bridge 9/132 Replacement Wetland Mitigation Plan. Project number OL2173.

Appendix A

The following excerpt is from the *SR 9 Stillaguamish/Haller Bridge 9/132 Replacement Wetland Mitigation Plan* (WSDOT 1997). Standards of success and contingency plans addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

Goals: The intention of this mitigation site is to replace the wetland types, acreage, and functions of the wetland impacted by this project by creating palustrine emergent, scrub-shrub, and forested wetlands with a wetland buffer.

- Provide wildlife habitat by increasing shrub and tree cover and habitat structures.
- Alter floodflow by increasing the amount and diversity of vegetative forms and the addition of organic soil.
- Provide contaminant buffering, by creating a densely vegetated wetland area to intercept sediment and contaminants.

Objective 1: The mitigation site will include 0.96 ha (2.37 ac) of emergent, scrub-shrub, and forested wetlands and 0.69 ha (1.71 ac) wetland buffer. The wetlands will have an initial planting of 31% emergent, 55% scrub-shrub, and 14% forest/ scrub-shrub vegetation.

Performance Standard:
All years:
A weed-free condition will be maintained, and irrigation necessary to ensure continued growth will be accomplished. Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species.

After one year:

- **Unsatisfactory or dead plantings will be replaced during first year plant establishment.**

After three years:

- The wetland will be comprised of $\geq$ 75% native facultative or wetter species, or will be comprised of a planted and native, naturally colonizing plant community at 50% or greater aerial cover.
- The buffer will be comprised of $\geq$ 75% native species, or will be comprised of a planted and native, naturally colonizing plant community at 50% or greater aerial cover.

After five years:

- The wetland will be comprised of $\geq$ 75% native facultative or wetter species, or will be comprised of a planted and native, naturally colonizing plant community at 80% or greater aerial cover.

- The buffer will be comprised of ≥ 75% native species, or will be comprised of a planted and native, naturally colonizing plant community at 80% or greater aerial cover.

Objective 2: Wildlife cover and forage availability for birds and small mammals should increase substantially. The addition of stumps, logs and brush piles will increase habitat diversity and structure. Wetland creation will provide feeding, breeding, and resting habitat for birds, small mammals, and amphibians

Performance Standard:
After three years:

- Increases in wildlife cover and forage species should improve habitat structure, which should result in a corresponding increase in wildlife use.

After five years:

- Wildlife cover and forage species should be established so that habitat structure changes from a single layer to multiple layers. An increase in wildlife species should be observable.

Contingency Plan #3:

The mitigation plan is designed to utilize and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species.

SR 9 Stillaguamish River Plant List

Species Name	Common Name	Status	Origin
Acer circinatum	Vine maple	FAC-	Native
Acer macrophylum	Bigleaf maple	FACU	Native
Agrostis capillaris	colonial bentgrass	FAC	Eurasia
Alopecurus geniculatus	Water foxtail	OBL	Intro
Alopecurus pratensis	Meadow foxtail	FACW	Eur
Amaranthus retroflexus	Redroot amaranth	FACU+	Intro
Cornus sericea	red-osier dogwood	FACW	Native
Dactylis glomerata	orchard grass	FACU	Eur
Echinochloa crusgali	Large barnyard grass	FACW	Eur
Epilobium ciliatum	hairy willow-herb	FACW-	Native
Gnaphalium uliginosum	Marsh cudweed	NL	Native
Holcus lanatus	common velvet grass	FAC	Eur
Juncus bufonius	Toad rush	OBL	Native
Malus fusca	Pacific crabapple	FACW	Native
Phalaris arundinacea	reed canarygrass	FACW	Nat & Intro
Phleum pratense	Common timothy	FAC-	Intro
Physocarpus capitatus	Pacific ninebark	FACW-	Native
Plantogo major	Broadleaf plantain	FACU+	Native
Poa laxiflora	Loose-flowered bluegrass	NL	Native
Polygonum arenastrum	Prostrate knotweed	FACW-	Intro
Populous balsamifera	Black cottonwood	FAC	Native
Ranunculus repens	creeping butter-cup	FACW	Eur
Rosa nutkana	Nootka rose	FAC	Native
Rubus spectabilis	Salmonberry	FAC+	Native
Salix spp	Willows	---	
Sambucus racemosa	Red elderberry	FACU	Native
Thuja plicata	Western red cedar	FAC	Native
Tsuga heterophylla	Western hemlock	FACU-	Native
Typha latifolia	broad-leaf cattail	OBL	Native

SR 18 Issaquah-Hobart, King County

The following report summarizes project activities completed by the Washington State Department of Transportation (WSDOT) Wetland Monitoring Program at the SR 18 Issaquah-Hobart wetland mitigation site in August 2000. Monitoring activities on this site included surveys of woody species cover.

Site Information

Site Name	SR 18 Issaquah-Hobart
Project Name	SR 18 Issaquah-Hobart Interchange
Permit Number	94-4-00203
Permitting Agency	USACE
Location	Milepost 19-22 King County, WA
Monitoring Period	1999-2003
Year of Monitoring	3 of 5
Area of Project Impact	2.25 ac (0.91 ha)
Type of Mitigation	Creation/Enhancement
Area of Mitigation	9.96 ac (4.03 ha)
Replacement Ratio	2:1

Management and Sampling Objectives

Monitoring objectives for this project were developed from success standards described in the *SR 18 Issaquah Hobart Interchange and Raging River Bridge Wetland Mitigation Plan* (WSDOT 1993). The complete text of the success standards for this project is listed in Appendix A. Success standards, management objectives, and sampling objectives addressed this year are presented below.

Success Standard
The wetland should have 50% areal coverage of forested and scrub-shrub species.

Success Standard
Upland and riparian forested buffer areas should have 50% cover by forested species planted, or be supplemented or replaced by a native naturally colonizing upland forested plant community at 50% or greater cover.

Management Objective 1
Achieve 50% aerial cover of forest and scrub-shrub species in the forested wetland and upland on the SR 18 Issaquah-Hobart mitigation site by 2001.

Sampling Objective 1
To be 80% confident the mean aerial cover estimate for forested and shrub species in the forested wetland and upland is within 20% of the true cover value.

Success Standard
Upland and riparian forested buffer areas should have 50% cover by forested species planted, or be supplemented or replaced by a native naturally colonizing upland forested plant community at 50% or greater cover.

Management Objective 2
Achieve 50% aerial cover of forested and scrub-shrub species in the riparian buffer on the SR 18 Issaquah-Hobart mitigation site by 2001.

Sampling Objective 2
To be 80% confident the mean aerial cover estimate for forested and shrub species in the riparian buffer is within 20% of the true cover value.

Success Standard
There will be at least six habitat structures (logs, stumps, snags, brush piles) within the boundary of the created wetland and at least twelve within the buffer area. These structures will provide perches, cover, and habitat diversity as planted vegetation matures.

Management Objective 3
To maintain 6 habitat structures in the created wetland area, and 12 within the buffer area.

Success Standard
The mitigation plan is designed to utilize and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species.

Management Objective 4
Limit the aerial cover of noxious weeds and exotic plant species to 10% or less on the SR 18 Issaquah-Hobart mitigation site.

Sampling Objective 4
To be 80% confident that mean aerial cover estimate for invasive exotic plant species in the created wetland area and buffer area is within 20% of the true cover value.

Methods
Two temporary macroplots were established within the site boundaries, one in the forested/scrub-shrub area and the other in the riparian buffer adjacent to Holder Creek. Transects for each macroplot were located using systematic random sampling and were extended perpendicular to a baseline. Woody species data were collected along each

transect within both macroplots. Invasive exotic species data were collected along each transect in the forested/scrub-shrub area.

Cover data for the woody species plant community were collected using the line-intercept method (Canfield 1941; Bonham 1989). All woody vegetation intercepting a tape measure stretched along each sampling transect was identified and the length of the canopy intercept was recorded.

The point intercept technique (Bonham 1989; Elzinga et al. 1998) was used to collect aerial cover data for herbaceous species along each sampling unit. Following a random start, point quadrats were systematically located along each transect. At each point location, a point intercept device was lowered vertically from above the tallest herbaceous vegetation on the west side of the transect tape. Each plant species intercepted by the point intercept device was recorded. If the point device did not intercept vascular plant species, data was recorded as bare soil, non-vascular plant, or habitat structure.

In the forested wetland and wetland buffer 25 transects of varying lengths were randomly placed along the baseline. In the riparian area, 43 transects of 31m in length were placed along the baseline.

In order to address management objective 4, data were gathered from 30 sample units placed within the forested wetland and wetland buffer area.

Sample size analysis confirmed achievement of the sampling objectives. The following equation was used to perform this analysis.

$$n = \frac{(z)^2(s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[1]
n = unadjusted sample size

Results

Aerial cover of woody species on both macroplots is below the 50% cover requirement in management objectives one and two with 13% aerial cover (CI 0.80 ± 0.20) in the forested/scrub-shrub area and 11% aerial cover (CI 0.80 ± 0.20) in the riparian area (Table 1).

Cover of invasive exotic plant species is estimated to be 15% (CI 0.80 ± 0.30), above the 10% threshold in objective 5. *Phalaris arundinacea* (reed canarygrass) is the most abundant invasive. Other invasives include: *Cirsium vulgare* (bullthistle), *Senecio jacobaea* (tansy ragwort), *Rubus armeniacus* (Himalayan blackberry), and *Geranium robertianum* (Robert's geranium) (Table 1). A complete list of species identified on site is listed in Appendix B.

[1] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

Only 7 of the required 18 habitat structures could be located on the site, therefore, management objective 3 is not being met.

Management Activities

Regional staff are planning remediation activities to address invasive species and the low aerial cover of woody vegetation in the riparian and wetland buffer areas and addition of habitat structures for the 2001 season.

Table 1. Woody and invasive species cover estimates compared with the cover required by the corresponding management objectives.

SR 18 Issaquah-Hobart	Woody Species in Forested/Scrub/Shrub Area (Objective 1)	Woody Species in Riparian area (Objective 2)	Invasive Species (Objective 4)
Total Aerial Cover	13% (CI 0.80 ± 0.20)	11% (CI 0.80 ± 0.20)	±15% (CI 0.80 ± 0.30)
Required Cover	50%	50%	≤10%
Dominant Species	*Pseudotsuga menziesii*	*Populus balsamifera*	

Literature Cited

Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

Canfield, R. H. 1941. Application of the Line Intercept Method in Sampling Range Vegetation. J. For. 39:388-394.

Reed, P. B. Jr. 1993. Supplement to List of Plant Species that Occur in Wetlands: Northwest Region (Region 9). U. S. Fish and Wildlife Service Supplement to Biological Report 88 (26.9).

Washington State Department of Transportation. 1993. Wetland Mitigation Plan SR 18 Issaquah-Hobart Interchange and Raging River Bridge.

Appendix B

The following excerpt is from the *Wetland Mitigation Plan SR 18 Issaquah-Hobart Interchange and Raging River Bridge* (WSDOT 1993). The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

Goals
The goal of the SR 18/Issaquah-Hobart Road Interchange wetland mitigation project is to create a forested wetland and forested upland buffer as in-kind mitigation for impacts to 0.16 acre of high quality forested wetland and 1.93 acres of buffer. In general, the created wetland, wetland buffer, and riparian buffer are expected to provide the following functions and values: fish and wildlife habitat, food chain support, water storage and attenuation, and sediment and nutrient trapping.

Objectives and Performance Standards
The following objectives and performance standards establish specific criteria that will be used by WSDOT to measure the mitigation site's success.

Objective 1 – Vegetation
The mitigation site will include 0.4 acres of forested wetland, 2.16 acres of wetland buffer and 1.25 acres of riparian buffer along Holder Creek. The vegetation planted will provide value as food chain support, as well as the functions of flood attenuation, and sediment and nutrient trapping as compared to the existing site conditions. The riparian vegetation planted along Holder Creek will assist in protection and enhancement of instream habitat. As this vegetation matures it will assist in providing shade, winter cover, and recruitment of large organic debris that will be available to enhance in-stream habitat.

Performance standards

<u>After 3 years:</u>

1a. The forested wetland should have 70% viability of planted species or be supplemented by natural recruitment of native facultative or wetter native wetland species.

1b. The wetland should have 50% areal coverage of forested and scrub-shrub species.

<u>After 5 years:</u>

1c. The wetland should have 80% areal cover of forested and scrub-shrub wetland vegetation.

Objective 2 – Wildlife

Wildlife habitat diversity will be increased by additions of native species plantings and from the combination of the establishment of early seral vegetation with the more mature forested vegetation existing at the site. The addition of stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetation areas. The created wetland will change over time from a largely bare fill area to a wetland dominated by woody vegetation. Overall, the creation of a forested wetland adjacent to Holder Creek will function to increase the value of the existing riparian habitat by providing additional feeding, breeding, and resting habitat for birds, small mammals, and amphibians. The mitigation site also assists in the extending vegetated corridor available for wildlife movement along Holder Creek. Implementation of the mitigation plan will result in an increase in habitat and the edge between habitat types.

Performance Standards

2. After 3 years**:**

2a. The forested wetland, wetland buffer, and riparian buffer should have 70% viability of planted tree and shrub species;

2b. There will be at least six habitat structures (logs, stumps, snags, brush piles) within the boundary of the created wetland and at least twelve within the buffer area. These structures will provide perches, cover, and habitat diversity as planted vegetation matures.

2c. There will be at least 400 linear feet of edge between forested wetland and upland.

After 5 years:

2d. Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed.

2e. The mitigation site should have 80% areal cover of trees and shrubs.

Objective #3: Buffers

There will be 2.24 acres of forested wetland buffer surrounding the created wetland. In addition to this there will be 2.32 acres of riparian buffer replaced along Holder Creek.

After 3 years**:**

3a. **Upland and riparian forested buffer areas should have 50% cover by forested species planted, or be supplemented or replaced by a native**

naturally colonizing upland forested plant community at 50% or greater cover.

After 5 years:

3b. Upland and riparian forested buffer areas should have 75% cover by forested buffer species planted, or be supplemented or replaced by a native naturally colonizing upland forested plant community at 75% or greater cover.

Objective #4 – Preservation

All areas proposed for preservation will be maintained in the permanent state ownership by WSDOT and will be so labeled on R/W plan sheets on file at WSDOT.

Contingency Plans

Mitigation goals will be accomplished with successful native vegetation plantings. Contingency plans will ultimately consist of replanting the site in case of planting failure or other unforeseen problems. The natural recruitment of native wetland species and upland species (to the buffer) throughout the mitigation site will assist any revegetation contingency plan.

In the event that the aerial coverage of forest wetland of forested buffer plants falls short of the listed performance standards, additional measures will be employed to assure the establishment of a viable wetland plant community at the site.

The following schedule summarizes how we assure achievement of performance standards and mitigation goals:

1. If the coverage of trees is less than 50% after the third growing season these species will be replanted. Sprigs, cuttings, seeds or live plant material will be replanted and monitored to assure that coverage meets performance standard criteria. Remedial work may occur if hydrology is not sufficient to support wetland vegetation.

2. If aerial coverage of wetland plants is less than 50% after the fourth year, resource agencies will be consulted for advice on further measures to remedy the problems at the site. The monitoring program will be extended and such reasonable measures will be performed as are necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland system.

3. **The mitigation plan is designed to utilize and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple**

loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species.

SR 18 Issaquah-Hobart Plant List 2000			
Species Name	**Common Name**	**Status**	**Origin**
Acer circinatum	vine maple	FAC-	Native
Acer macrophyllum	bigleaf maple	FACU	Native
Agrostis alba	redtop	FAC	Eur
Agrostis capillaris	colonial bentgrass	FAC	Eurasia
Alnus rubra	red alder	FAC	Native
Anthoxanthum odoratum	sweet vernal grass	FACU	Eur
Bromus commutatus	Meadow brome	--	Intro
Cirsium vulgare	bull thistle	FACU	Eur
Cornus sericea	red-osier dogwood	FACW	Native
Dactylis glomerata	orchard grass	FACU	Eur
Deschampsia caespitosa	tufted hairgrass	FACW	Native
Eleocharis ovata	ovate spikerush	OBL	Native
Equisetum telmateia	giant horsetail	FACW	Native
Festuca arundinacea	tall fescue	FAC-	Eur
Festuca rubra	red fescue	FAC+	Native
Fraxinus latifolia	Oregon ash	FACW	Native
Geranium robertianum	Robert geranium	NL	Native
Holcus lanatus	common velvet grass	FAC	Eur
Juncus effusus	soft rush	FACW	Native
Lonicera involucrata	black twinberry	FAC+	Native
Lotus corniculatus	birdsfoot trefoil	FAC	Eur
Ludwigia palustris	marsh seedbox	OBL	Native
Phalaris arundinacea	reed canarygrass	FACW	Nat & Intro
Phleum pratense	common timothy	FAC-	Intro
Poa trivialis	rough bluegrass	FACW	Intro
Populus balsamifera	black cottonwood	FAC	Native
Pseudotsuga menziesii	Douglas fir	FACU	Native
Ranunculus repens	creeping butter-cup	FACW	Eur
Rosa sp.	Rose	---	
Rubus laciniatus	evergreen blackberry	FACU+	Eur
Rubus parviflorus	western thimbleberry	FAC-	Native
Rubus spectabilis	salmonberry	FAC+	Native
Salix lucida	Pacific willow	FACW+	Native
Salix sitchensis	Sitka willow	FACW	Native
Salix sp.	Willows	---	

SR 18 Issaquah-Hobart Plant List 2000			
Species Name	**Common Name**	**Status**	**Origin**
Sambucus racemosa	red elderberry	FACU	Native
Scirpus microcarpus	small-fruit bulrush	OBL	Native
Senecio jacobaea	tansy ragwort	FACU	Eur
Sonchus asper	prickly sowthistle	FAC-	Intro
Symphoricarpos albus	common snowberry	FACU	Native
Thuja plicata	western red cedar	FAC	Native
Trifolium hybridum	alsike clover	FAC	Intro
Tsuga heterophylla	western hemlock	FACU-	Native
Typha latifolia	broad-leaf cattail	OBL	Native
Vicia sativa	common vetch	UPL	Intro
Vicia tetrasperma	slender vetch	NL	Eur

SR 18 Pumpkin Patch, King County

The following report summarizes project activities completed by the Washington State Department of Transportation (WSDOT) Wetland Monitoring Program at the SR 18 Pumpkin Patch wetland mitigation site in August 2000. Activities include surveys of tree and shrub species cover.

Site Information

Site Name	SR 18 Pumpkin Patch
Project Name	SR 18 Auburn-Black Diamond Rd. to SE 312th Way
Permit Number	93-4-00146
Permitting Agency	USACE
Location	King County, Washington
Monitoring Period	1998-2002
Year of Monitoring	3 of 5
Area of Project Impact	0.33 ac (0.13 ha)
Type of Mitigation	Wetland restoration
Area of Mitigation	0.65 ac (0.26 ha)
Replacement Ratio	2:1

Management and Sampling Objectives

Monitoring objectives for the SR 18 Pumpkin Patch mitigation site were developed from success standards described in the *Wetland Mitigation Plan State Route 18 Auburn-Black Diamond Road to SE 312th Way* (WSDOT 1993). The complete text of the success standards for this project is listed in Appendix C. Success standards, management objectives, and sampling objectives addressed this year are presented below.

Success Standard

The wetland should have 75% survival of facultative (FAC) or wetter species (Reed 1993) or should be supplemented or replaced by a native naturally colonizing plant community at 75% or greater cover.

Management Objective 1

Achieve 75% or greater aerial cover of native woody species in the wetland zone of the SR 18 Pumpkin Patch mitigation site in year 2000.[1]

Sampling Objective 1

To be 80% confident that the mean aerial cover estimate for native woody species in the wetland zone is within 20% of the true cover value.

[1] The mitigation plan (WSDOT 1993) prescribes 75% survival of facultative and wetter species in the wetland zone as alternative success criteria. Measuring survival after the first year of planting is problematic due to mortality and natural recruitment. The WSDOT Monitoring Program has chosen aerial cover as a better attribute with which to measure success of plantings in the wetland zone on this site.

Success Standard
The buffer has 50-75% areal coverage of native species planted or is supplemented or replaced by native vegetation at 75% or greater cover.

Management Objective 2
Achieve 50% or greater aerial cover of native woody species in the wetland buffer zone of the SR 18 Pumpkin Patch mitigation site in year 2000.

Sampling Objective 2
To be 80% confident that the mean aerial cover estimate for native woody species in the wetland buffer zone is within 20% of the true cover value.

Methods
A sampling macroplot was strategically positioned to include both wetland and wetland buffer vegetation zones at the Pumpkin Patch mitigation site. Following a random start, 25 transects were located using a systematic random sampling method along a 120-m baseline at the southern site boundary. Transects were extended perpendicular to the baseline and were terminated at varying lengths along the northern site boundary. Tree and shrub species cover data were collected along sampling transects.

Cover data for the woody species plant community were collected using the line-intercept method (Canfield 1941; Bonham 1989). All woody vegetation intercepting tape measures stretched along each sampling transect was identified and the length of the canopy intercept was recorded. To achieve the statistical confidence interval specified in sampling objectives one and two, 25 sampling units were randomly located along transect lengths within both the wetland zone and the wetland buffer zone.

Sample size analysis confirmed achievement of the sampling objectives. The following equation was used to perform this analysis.

$$n = \frac{(z)^2(s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[2]
n = unadjusted sample size

Results and Discussion
The mean aerial cover estimate for native woody species in the wetland zone is 70% (CI 0.90 ± 0.10). This value is within the confidence interval, indicating the true cover value may meet the desired cover level.

The mean aerial cover estimate for native tree and shrub species in the wetland buffer is 36% (CI 0.90 ± 0.20) approaching the required 50% cover specified in management

[2] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

objective two (Table 1). Although the management objective was not achieved in this zone, qualitative observations indicate a high survival rate of planted material with cover slightly below the desired level.

Appendix A includes a list of woody plant species recorded during our monitoring visit to the SR 18 Pumpkin Patch mitigation site in 2000.

Overall, quantitative data and visual observations indicate that the Pumpkin Patch mitigation site is developing as intended. A woody plant community with both structural and species diversity is developing in both the wetland and wetland buffer zones. Within the wetland area, scrub-shrub and forested wetland classes are present and are expected to become even more pronounced over time.

Table 1. Cover estimates for native woody species in the wetland zone, and native woody species in the wetland buffer are approaching the cover levels specified in management objectives one and two.

SR 18 Pumpkin Patch	Native Woody Species (Wetland) (Objective 1)	Native Woody Species (Wetland Buffer) (Objective 2)
Total Aerial Cover	70% (CI 0.90 ± 0.10)	36% (CI 0.90 ± 0.20)
Management Objective	75%	50%
Dominant Species	*Alnus rubra*	*Cornus sericea*
	Cornus sericea	*Picea sitchensis*
	Salix sp.	*Symphoricarpos albus*

Literature Cited

Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

Canfield, R. H. 1941. Application of the Line Intercept Method in Sampling Range Vegetation. J. For. 39:388-394.

Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management Technical Reference 1730-1, BLM/RS/ST-98/005+1730.

Reed, P. B. Jr. 1993. Supplement to List of Plant Species that Occur in Wetlands: Northwest Region (Region 9). U. S. Fish and Wildlife Service Supplement to Biological Report 88 (26.9).

Washington State Department of Transportation. 1993. Wetland Mitigation Plan State Route 18 Auburn-Black Diamond Road to SE 312th Way. Project number OL1338.

United States Army Corps of Engineers. 1994. Department of the Army Permit. Number 93-4-00146.

Appendix C

The following excerpt is from the *Wetland Mitigation Plan State Route 18 Auburn-Black Diamond Road to SE 312th Way* (WSDOT 1993). The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

Goals, Objectives and Standards of Success

Goals: The goal of this mitigation project is to restore and preserve wetland habitat. The site should provide wildlife habitat, food chain support, flood storage, biofiltration, and sediment and nutrient trapping. It should also develop a multi-canopy structure along with a species density and diversity similar to that of the impacted areas.

Objective #1: Restore a wetland system that has vegetation which is expected to provide structural and species diversity similar to those found in the red alder/willow/dogwood forest system adjacent to the mitigation site.

Standard of Success:

After three years:

- The wetland should have 75% survival of facultative (FAC) or wetter species (Reed 1993**) or should be supplemented or replaced by a native naturally colonizing plant community at 75% or greater cover.**
- Scrub-shrub and forested wetland classes will be established.

After five years:

- The wetland should have about 35-50% scrub-shrub coverage with at least two species providing 30% of this cover each.
- About 50-80% forested coverage with at least two species providing 40% of the aerial coverage each.
- Both the scrub-shrub and forested wetland should have 90% native species.
- All trees planted in the forested zone should have 90% viability.

Objective #2: Provide wildlife support. Habitat for wetland dependent and other species should be increased as compared to the existing habitat value. Restoration of habitat will focus on the number of habitat types and the number and extent of vegetation canopy levels. Cover and forage availability for birds and small mammals should increase significantly. Wildlife habitat will be measured by aerial cover of woody vegetation, the number of wetland classes, and availability of standing water.

Standard of Success:

After three years:

- **Two wetland classes will be present.**
- **Sapling trees should be established.**
- At least 1000 feet of ecotone habitat will be created as measured by an increase in the edge between different habitat types over the pre-construction site conditions.

After five years:

- Scrub-shrub and forested wetland classes will be present.

An increase in wildlife species should be observable.

Objective #3: A buffer of native upland and transitional plants is proposed along the mitigation site's southern and westerly edges to cushion both wildlife and the new plantings from external disturbance. An additional buffer will come from revegetating the existing steep embankment to the north. The existing undisturbed native vegetation will provide a buffer along the site's northeasterly and southeasterly sides.

Standard of Success:
After three years:

- **The buffer has 50-75% areal coverage of native species planted or is supplemented or replaced by native vegetation at 75% or greater cover.**

After five years:

- The buffer has 50-75% areal coverage of native species.
- The buffer width will range from 10 to 50 feet as shown on design plans in Appendix 5, and be measurable.

Objective #4: The mitigation site a well as adjacent pre-existing wetland areas will be left undisturbed, and be protected in perpetuity by permenent WSDOT ownership. A copy of the deed (title of ownership) is in Appendix 6.

SR 509 Pumpkin Patch Woody Plant Species List

Species Name	Common Name	Status	Origin
Acer circinatum	vine maple	FAC-	Native
Alnus rubra	red alder	FAC	Native
Cornus sericea	red-osier dogwood	FACW	Native
Fraxinus latifolia	Oregon ash	FACW	Native
Physocarpus capitatus	Pacific ninebark	FACW-	Native
Picea sitchensis	Sitka spruce	FAC	Native
Rosa nutkana	Nootka rose	FAC	Native
Rubus armeniacus	Himalayan blackberry	FACU	Eur
Rubus spectabilis	salmonberry	FAC+	Native
Salix sp.	willows	---	
Salix lucida	Pacific willow	FACW+	Native
Spiraea douglasii	Douglas' spiraea	FACW	Native
Symphoricarpos albus	common snowberry	FACU	Native
Thuja plicata	western red cedar	FAC	Native

SR 99 First Avenue, King County

The following report summarizes monitoring activities completed at the SR 99 First Avenue Bridge mitigation site during the summer of 2000 by the Washington State Department of Transportation (WSDOT) Wetland Mitigation Program. Activities include vegetation surveys for cover of invasive species, woody species and emergent vegetation.

Site Information

Site Name	SR 99 First Avenue
Project Name	First Avenue South New Bridge Project
Permit Number	93-2-01249
Permitting Agency	USACE
Location	South Bridge Replacement, Seattle, King Co.
Monitoring Period	1998-2002
Year of Monitoring	3 of 5
Area of Project Impact	1.04 ac (0.42 ha)
Type of Mitigation	Creation/Enhancement
Area of Mitigation	2.08 ac (0.84 ha)
Replacement Ratio	2:1

Management and Sampling Objectives

Monitoring tasks and associated management and sampling objectives were developed from the Standards of Success contained in the *SR 99 First Avenue South New Bridge Project Wetland Mitigation Plan* (Aberle et. al. 1994). The complete text of the success standards for this project is listed in Appendix D. Success standards, management objectives, and sampling objectives addressed this year are presented below.

Success Standard

The wetland has 50% survival of facultative or wetter species, or is supplemented or replaced by a native wetland plant community regenerating at 50% or greater cover.

Management Objective 1

Achieve 50% aerial cover of native wetland plant species in the emergent area at the SR 99 First Avenue Mitigation site by 2000.

Sampling Objective 1

To be 80% confident the estimated aerial cover of native wetland species is within 20% of the true cover value.

Success Standard
The upland buffer area should have 30-50% cover by forested and shrub species planted, or be supplemented or replaced by a native naturally colonizing upland plant community at 50% or greater cover.

Management Objective 2
Achieve 50% aerial cover of native woody species in the upland buffer areas at the SR 99 First Avenue Mitigation site by 2000.

Sampling Objective 2
To be 80% confident the estimated aerial cover of planted or naturally occurring upland woody species is within 20% of the true cover value.

Success Standard
The mitigation plan is designed to utilize and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic species and not allow them to dominate the site. Noxious weeds, such as purple loosestrife, will be eliminated immediately if found occurring on the site before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species. It is expected that common reed grass will likely invade a portion of the created wetland. If it appears that this species is dominating the site, then resource agencies will be contacted to determine an appropriate course of action for control.

Management Objective 3
Limit the aerial cover of noxious and invasive plant species to 10% or less at the SR 99 First Avenue Mitigation site during 1998-2002.

Sampling Objective 3
To be 80% confident the estimated aerial cover of noxious and invasive plant species is within 20% of the true cover value.

Methods
In order to evaluate herbaceous and woody vegetation, a temporary macroplot was established on site. Transects were established using systematic random sampling and were extended perpendicular to the baseline.

The point-intercept technique (Bonham 1989; Elzinga et al. 1998) was used to collect aerial cover data for herbaceous species along each sampling unit. Following a random start, point quadrats were systematically located along each transect. At each point location, a point intercept device was lowered vertically from above the tallest herbaceous vegetation on the west side of the transect tape. Each plant species intercepted by the point intercept device was recorded. If the point device did not intercept vascular plant

species, data was recorded as bare soil, non-vascular plant, or habitat structure. To achieve the statistical confidence interval specified in sampling objectives one and two, points were taken along 20 10-meter sample units. In the wetland zone, 40 quadrats were randomly placed and aerial cover of plant species was qualitatively estimated within each quadrat.

Cover data for the woody species plant community was collected using the line-intercept method (Canfield 1941; Bonham 1989). All woody vegetation intercepting a tape measure stretched along each sampling transect was identified and the length of the canopy intercept was recorded. To achieve the statistical confidence interval specified in sampling objective three, data was taken from 40 10-meter sample units that were randomly placed along sampling transects.

Sample size analysis confirmed achievement of the sampling objectives. The following equation was used to perform this analysis.

$$n = \frac{(z)^2(s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[1]
n = unadjusted sample size

Four bird surveys were conducted at the mitigation site from May through July. The point count method (Ralph et al. 1993) was used to document species presence and relative abundance.

Results and Discussion

The aerial cover estimate of native wetland species is 65% (CI 0.95 ± 0.14) which is above the required value of 50% for the third year in Objective 1.

The aerial cover of woody species in the upland area is 3% (CI 0.80 ± 0.20) and is far below the 50% cover required for the third year in Objective 2.

The aerial cover of invasive species on the site is 11% (CI .80 ± 0.20), which exceeds the required value set in Objective 3. A complete list of species identified on site is provided in Appendix D.

The bird community is diverse with 22 species of birds from 14 avian families. Six of the species are wetland dependent; Canada goose, Gadwall, Green Heron, Mallard, Red-winged Blackbird, and Spotted Sandpiper. Barn Swallows are known to frequently use wetlands for feeding and breeding and are present on the site as well. A Peregrine falcon

[1] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

was observed flying through the site during a survey. A complete list of bird species identified on site is provided in Appendix D.

Management Activities

Regional staff has been notified and mowing of the *Phragmites australis* is planned for summer, followed by chemical treatment in the fall. Additional management activities are under consideration to address low cover of woody species in the upland area.

Table 1. Woody, invasive, and native wetland species cover estimates compared with the corresponding cover required by the corresponding management objectives.

SR 99 First Avenue	Native Wetland Cover	Woody Cover	Invasive Cover
Total Aerial Cover	65%	3%	11%
Management Objective	50%	50%	≤10%
Dominant Species	*Eleocharis parvula*	*Rosa nutkana*	*Phragmites australis*

Literature Cited

Aberle, B., S. T. Clay-Poole, D. Myers, and R. Robohm. 1994. SR 99 First Avenue South New Bridge Project Detailed Wetland Mitigation Plan. Washington State Department of Transportation District 4.

Bonham, C.D. 1989. Measurements for terrestrial vegetation. John Wiley & Sons, New York, NY.

Canfield, R. H. 1941. Application of the Line Interception Method in Sampling Range Vegetation. J. For. 39:388-394.

Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1988. The Birders Handbook. Simon and Schuster Inc., New York, 785 pp.

Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management Technical Reference 1730-1, BLM/RS/ST-98/005+1730.

Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Handbook of Field Methods for Monitoring Landbirds. Gen. Tech. Rep. PSW-GTR-144. Albany, CA: Pacific Southwest Research Station, Forest Service, Department of Agriculture.

Appendix D

The following excerpt is from the *SR 99 First Avenue South New Bridge Project Detailed Wetland Mitigation Plan* (Aberle et. al. 1994). The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

Goals, Objectives and Standards of Success

The goal of the 1st Ave Bridge South wetland mitigation project is to create a self sustaining estuarine palustrine emergent wetland that will be of higher value than the degraded area it will replace. Wetland manageability and viability will be enhanced by the establishment of upland buffer. In general, the created wetland system is expected to provide the following functions and values: wildlife habitat, food chain support, water storage and attenuation, and sediment and nutrient trapping.

Excavation and contour grading combined with vegetation establishment will be used to alter the existing site conditions from a predominantly degraded area to an emergent inter-tidal wetland. The surrounding buffer will provide habitat and protect the site from human intrusion and noise and glare associated with adjacent roadways.

Objectives and Performance Standards

The following objectives and performance standards establish specific criteria that will be used by WSDOT and regulatory agencies to measure the mitigation site's success. The objectives below specify the direct actions that are necessary to achieve the goal of the mitigation project. The performance standards provide the specific measurements used to evaluate whether the goals and objectives are being met.

Objective 1 – Vegetation

This mitigation site will have a vegetation structure and species diversity of higher quality when compared to the existing degraded wetland and upland at the site.

Performance standards

After 3 years:

1a. The wetland has 50% survival of facultative or wetter species, or is supplemented or replaced by a native wetland plant community regenerating at 50% or greater cover.

1b. One wetland class (emergent wetland) will be established within the created channel.

After 5 years:

1c. The wetland has 75-80% cover by emergent vegetation of facultative or wetter species.

1d. Emergent wetland has 75% or greater dominance of native species.

Objective 2 – Wildlife

Wildlife habitat diversity will be increased by additions of native species plantings in the wetland channel and the buffer vegetation adjacent to the channel. The addition of artificial nesting sites, stumps, logs, and brush piles will increase the habitat diversity and structure in the newly vegetated areas. The created wetland will change over time from an area consisting of fill to a wetland dominated by emergent vegetation. Implementation of the mitigation plant will result in the increase in habitat and the edge between habitat types.

Performance standards

After 3 years:

2a. The emergent wetland and wetland buffer should have 50% viability of planted tree and shrub species.

2b. Two habitat types, emergent wetland and upland buffer will occur at the site.

2d. There will be at least eight habitat structures (logs, stumps, snags, brush piles) within the boundary of the mitigation site. These structures will provide perches, cover, and habitat diversity as the planted vegetation matures.

2e. There will be at least 3,000 linear feet of edge between wetland and upland.

After 5 years:

2d. Habitat structure will change from a single layer of vegetation to multiple layers over time as trees, shrubs and emergents mature.

2e. The wetland system will be dominated by emergent vegetation and will be tidally inundated twice each day.

2f. The mitigation site should have 75-80% cover by emergent vegetation of FAC or wetter species.

Objective #3: Buffers

There will be at least 50 feet of forested/scrub/shrub upland buffer surrounding the created channel.

Performance standards

After 3 years:

3a. **The upland buffer area should have 30-50% cover by forested and shrub species planted, or be supplemented or replaced by a native naturally colonizing upland plant community at 50% or greater cover.**

After 5 years:

3b. Upland forested/shrub buffer area should have 75% cover by species planted, or be supplemented or replaced by a native naturally colonizing upland plant community at 75% or greater cover.

3c. Buffer width will average between 30-50 feet.

Contingency Plans.

Mitigation goals will be accomplished with successful native plant seeding. Contingency plans will ultimately consist of planting the site in case of seeding failure or other unforeseen problems. The natural recruitment of native wetland species and upland species (to the buffer) through the mitigation site will assist any revegetation contingency plan.

In the event that the aerial coverage of wetland or buffer plants falls short of the listed performance standards, additional measures will be employed to assure the establishment of a viable wetland plant community at the site.

The following schedule summarizes how we assure achievement of performance standards and mitigation goals:

1. If the coverage of emergent vegetation is less than 25% after the third growing season the process of seeding should be reconsidered over the planting of seedlings. Sprigs, cuttings, or live plant material might be planted and monitored closely to assure that coverage meets performance standard criteria. Remedial work may occur if hydrology is not sufficient to support wetland vegetation.
2. If the coverage of seedling trees and shrubs within the buffer area is less than 25% after the third growing season these species will be replanted.
3. If aerial coverage of wetland and upland plants is less than 50% after the fourth year, resource agencies will be consulted for advice on further measures to remedy the problems at the site. The monitoring program will be extended and such reasonable measures will be performed as are necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland system.

4. **The mitigation plan is designed to utilize and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic species and not allow them to dominate the site. Noxious weeds, such as purple loosestrife, will be eliminated immediately if found occurring on the site before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species. It is expected that common reed grass will likely invade a portion of the created wetland. If it appears that this species is dominating the site, then resource agencies will be contacted to determine an appropriate course of action for control.**

SR 99 First Avenue Plant Plant List for 2000			
Scientific Name	**Common Name**	**Status**	**Origin**
Acer circinatum	vine maple	FAC-	Native
Agrostis alba	redtop	FAC	Eur
Agrostis capillaris	colonial bentgrass	FAC	Eurasia
Alnus rubra	red alder	FAC	Native
Aster modestus lindl	giant mountain aster	FACW	Native
Centaurium umbellatum	European centaury	NOL	Intro
Cirsium arvense	Canada thistle	FACU+	Eur
Cornus sericea	red-osier dogwood	FACW	Native
Corylus cornuta	beaked hazelnut	FACU	Native
Cotula coronopifolia	brassbuttons	FACW+	Intro
Crataegus douglasii	Douglas' hawthorn	FAC	Native
Cytisus scoparius	Scotch broom	UPL	Intro
Daucus carota	Queen Anne's lace	NL	Eur
Deschampsia caespitosa	tufted hairgrass	FACW	Native
Eleocharis parvula	small spikerush	OBL	Eur
Epilobium paniculatum	Tall annual willowherb	NL	Native
Festuca rubra	red fescue	FAC+	Native
Fragaria chiloensis	coastal strawberry	FAC	Native
Grindelia integrifolia	entire-leaved gumweed	FACW	Native
Holodiscus discolor	ocean spray	NL	Native
Juncus effusus	soft rush	FACW	Native
Leontodon taraxacoides	hairy hawkbit	UPL	Native
Lotus corniculatus	birdsfoot trefoil	FAC	Eur
Lotus purshiana	Spanish clover	NL	Native
Phragmites australis	common reed	FACW+	Native
Physocarpus capitatus	Pacific ninebark	FACW-	Native
Picea sitchensis	Sitka spruce	FAC	Native
Plantago lanceolata	English plantain	FAC	Eur
Plantago major	broadleaf plantain	FACU+	Native
Poa bulbosa	bulbous bluegrass	NL	Intro
Potentilla anserina	Pacific silverweed	OBL	Native
Pseudotsuga menziesii	Douglas fir	FACU	Native
Rosa nutkana	Nootka rose	FAC	Native
Rubus armeniacus	Himalayan blackberry	FACU	Eur
Rubus laciniatus	evergreen blackberry	FACU+	Eur
Rubus spectabilis	salmonberry	FAC+	Native

SR 99 First Avenue Plant Plant List for 2000			
Scientific Name	**Common Name**	**Status**	**Origin**
Salix sitchensis	Sitka willow	FACW	Native
Scirpus americanus	American three square	OBL	Native
Scirpus maritimus	seacoast bulrush	OBL	Native
Spergularia marina	saltmarsh sandspurry	OBL	Native
Symphoricarpos albus	common snowberry	FACU	Native
Tanacetum vulgare	common tansy	NI	Intro

SR 99 First Avenue Bird Species List for 2000

Common Name	Scientific Name	Family Name	*Wetland Dependent
American Crow	*Corvus brachyrhynchos*	Corvidae	
American Goldfinch	*Carduelis tristis*	Fringillidae	
American Robin	*Turdus migratorius*	Turdidae	
Barn Swallow	*Hirundo rustica*	Hirundinidae	
Black-capped Chickadee	*Parus atricapillus*	Paridae	
Brewer's Blackbird	*Euphagus cyanocephalus*	Icteridae	
Canada Goose	*Branta canadensis*	Anatidae	X
Cliff Swallow	*Hirundo pyrrhonota*	Hirundinidae	
European Starling	*Sturnus vulgaris*	Sturnidae	
Gadwall	*Anas strepera*	Anatidae	X
Green Heron	*Butorides striatus*	Ardeidae	X
House Finch	*Carpodacus mexicanus*	Fringillidae	
Killdeer	*Charadrius vociferus*	Charadriidae	
Mallard	*Anas platyrhynchos*	Anatidae	X
Peregrine Falcon	*Falco peregrinus*	Falconidae	
Red-winged Blackbird	*Agelaius phoeniceus*	Icteridae	X
Rock Dove	*Columba livia*	Columbidae	
Rufous Hummingbird	*Selasphorus rufus*	Trochilidae	
Song Sparrow	*Melospiza melodia*	Emberizidae	
Spotted Sandpiper	*Actitis macularia*	Scolopacidae	X
Violet-green Swallow	*Tachycineta thalassina*	Hirundinidae	
White-crowned Sparrow	*Zonotrichia leucophrys*	Emberizidae	

SR 202 Patterson Creek #2, King County

The following report summarizes project activities completed by the Washington State Department of Transportation (WSDOT) Wetland Monitoring Program at the SR 202 Patterson Creek #2 mitigation site during the spring and summer of 2000. Activities include vegetation surveys and measurements of hydrology.

Site Information
Two mitigation sites (SR 202 Patterson Creek #2 and SR 202 Dry Creek Re-channelization) provide compensation for impacts from three projects (SR 202 Vicinity SE 8th Street to Vicinity 300th Ave SE Settlement Correction/Channelization - OL-1596, Junction 244th Ave NE Channelization – OL-2259, and NE Ames Lake Road Vicinity – OL-2260)

Site Name	Patterson Creek #2
Project Names	SR 202 Vicinity SE 8th … Settlement Correction, Junction 244th Ave NE Channelization, and NE Ames Lake Road Vicinity
Work Order	C 5093
Permit Number	96-4-00944 (NWP 23)
Permitting Agency	USACOE
Location	3 miles west of Fall City, King Co.
Monitoring Period	2000 to 2004
Year of monitoring	1 of 5
Area of project impact	0.4 ha (1.0 ac)
Type of mitigation	Category II, III, and IV Enhancements
Mitigation Ratios	4:1, 2:1, and 1.5:1
Area of mitigation	0.1 ha (0.2 ac), 0.4 ha (1.1 ac), and 0.2 ha (0.6 ac)

Management and Sampling Objectives
Management and sampling objectives were developed from 5th year Standards of Success described in the *Final Mitigation Plan Vicinity SE 8th St. to Vicinity 300th Ave SE Settlement Correction/Channelization and Junction 244th Avenue NE Channelization, and NE Ames Lake Road Vicinity SR 202* (Ossinger and Tolon 1997). The complete text of the success standards for this project is listed in Appendix E. Success standards, management objectives, and sampling objectives addressed this year are presented below.

Success Standard
Minimum of 80% survival of planted trees and shrubs, with no less than 25% survivorship within each individual species.

Management Objective 1
Achieve a minimum of 80% survival of planted tree and shrub species at the SR 202 Patterson Creek #2 mitigation site in 2000. Survival will be 25% or greater for each planted species.

Sampling Objective 1
To be 80% confident that the survival estimate for woody species is within 20% of the true species survival.

Success Standard
The areal cover of reed canarygrass in the planted scrub-shrub and forested zones will not exceed 15%.

Management Objective 2
Limit mean aerial cover of *Phalaris arundinacea* (reed canarygrass) to 15% or less in each year between 2000 and 2004.

Sampling Objective 2
To be 80% confident that mean aerial cover estimate for *Phalaris arundinacea* is within 20% of the true species cover value.

Methods
A temporary macroplot was strategically placed within the site boundaries. Transects were established using a systematic random sampling method, and extended perpendicular to the 100-m baseline. Quadrats were positioned lengthwise along each of the transects. Survival information was obtained from 20 quadrats. Species composition and an indication of vigor (alive or dead) were recorded for each sample unit.

The point intercept technique (Bonham 1989; Elzinga et al. 1998) was used to collect aerial cover data for herbaceous species along each sampling transect. Following a random start, 40 point quadrats were located on each transect. At each point location, a pin flag was lowered vertically from above the tallest herbaceous vegetation on the south side of the transect tape. Each plant species intercepted by the pin flag was recorded. If the pin did not intercept vascular plant species, data was recorded as bare soil, non-vascular plant, or habitat structure. These data were evaluated to obtain an estimate of mean aerial cover of *P. arundinacea* on the site.

The following formula was used to determine the statistical credibility of the data.

$$n = \frac{(z)^2(s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[1]
n = unadjusted sample size

Results and Discussion

Based on data collected in mid-July, the estimated survival for planted woody species was 98% (CI 0.80 ± 0.27). While observations indicate that plantings were in good condition in May and July, observations made later in the growing season documented an increased number of stressed and dying plants. *Cornus sericea* (red-osier dogwood) did not appear to be doing well, and survival for this species may not meet the 25% requirement.

Analysis of point intercept data indicates that the aerial cover of *P. arundinacea* on the site is 22% (CI 0.80 ± 0.23). This estimate exceeds the 15% threshold specified in the mitigation plan (Ossinger and Tolon 1997) standards of success. Appendix E includes a list of plant species recorded during our 2000 site visit.

During each of three site visits in early May through mid-July 2000, water depth at the staff gauge and in low areas was 10 to 20cm, and the rest of the site was saturated to the surface. Prolonged saturation to the surface may have negatively affected the vigor of planted woody species.

Management Activities:

Phalaris arundinacea was sprayed in late October 1999 and will be sprayed again in April and August 2001. Additional management options are being evaluated by regional staff.

[1] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

Table 1. The estimate of survival for planted woody species shows that the management objective has been achieved. Cover estimates for *Phalaris arundinacea* show management objectives have not been achieved.

Patterson Creek #2	**Survival of Planted Woody Species (Management Objective 1)**	***Phalaris arundinacea* (Management Objective 2)**
Estimate	98% Survival	22% Aerial Cover
Management Objective	Achieved	Not Achieved
Dominant Species	*Cornus sericea*	*Juncus effusus*
	Salix lucida	*Ranunculus repens*
	Salix scouleriana	*Lotus corniculatus*

Literature Cited

Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

Canfield, R. H. 1941. Application of the Line Intercept Method in Sampling Range Vegetation. J. For. 39:388-394.

Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management Technical Reference 1730-1, BLM/RS/ST-98/005+1730.

Ossinger, M., and Tolon, M. 1997. Final Wetland Mitigation Plan Vicinity SE 8th St. to Vicinity 300th Ave SE Settlement Correction/Channelization and Junction 244th Avenue NE Channelization, and NE Ames Lake Road Vicinity SR 202. Washington State Department of Transportation, Environmental Affairs Office, Olympia WA.

Reed, P. B. Jr. 1993. Supplement to List of Plant Species that Occur in Wetlands: Northwest Region (Region 9). U. S. Fish and Wildlife Service Supplement to Biological Report 88 (26.9).

United States Army Corps of Engineers. 1996. Department of the Army Permit Number 96-4-00944.

Appendix E

The following excerpt is from the Final Mitigation Plan *Vicinity SE 8th St. to Vicinity 300th Ave SE Settlement Correction/Channelization and Junction 244th Avenue NE Channelization, and NE Ames Lake Road Vicinity SR 202* (Ossinger and Tolon 1997). This mitigation plan applies to both the SR 202 Patterson Creek #2 mitigation site and the SR 202 Dry Creek re-channelization sites. The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

Goals: The goal of this compensatory mitigation project is to improve the overall wetland functioning of a degraded Patterson Creek wetland, especially with regard to wildlife habitat.

Objective 1: Alter the water regime in the emergent zone (to be preserved in the southwest portion of the enhancement area) to increase the duration of shallow ponding without endangering the survival of woody species.

Standard of Success:
All years :

- **The existing emergent area shall be ponded to a depth of 40 cm in the spring and shall be shallowly ponded (at least in patches) in late summer.**

Objective 2: Establish a variety of native trees and shrubs in the designated enhancement area.

Performance Standard:
After one year:

- **Minimum of 80% survival of planted trees and shrubs, with no less than 25% survivorship within each individual species.**

After three years:

- Minimum of 60% survival of planted trees and shrubs, with no fewer than 75% of the total number of planted species remaining. (i.e., if 20 species are planted, at least 15 of those species will be present.)

After five years :

- Evident plant community zonation in the enhancement area, with scrub-shrub, deciduous forested wetland, and mixed forested wetland zones represented. The forested wetlands to be dominated by tree species, although individuals may be less than 6 meters tall.

- There will be a minimum of 0.12 ha (0.30 ac) scrub-shrub wetland, 0.15 ha (0.37 ac) deciduous forested wetland, and 0.10 ha (0.25 ac) mixed forested wetland.

Objective 3: Reduce occurrence of reed canarygrass in the scrub-shrub and forested zones of the enhancement area.

Performance Standard:

All years :

- **The areal cover of reed canarygrass in the planted scrub-shrub and forested zones will not exceed 15%.**

Patterson Creek #2 Plant List 2000

Species Name	Common Name	Status	Origin
Agrostis alba	redtop	FAC	Eur
Agrostis capillaris	colonial bentgrass	FAC	Eurasia
Athyrium filix-femina	subarctic lady fern	FAC	Native
Caltha leptosepala	elkslip marsh marigold	OBL	Native
Carex sp.	sedge	---	
Carex stipata	sawbeak sedge	OBL	Native
Cirsium arvense	Canada thistle	FACU+	Eur
Cornus sericea	red-osier dogwood	FACW	Native
Eleocharis ovata	ovate spikerush	OBL	Native
Epilobium ciliatum	hairy willow-herb	FACW-	Native
Equisetum palustre	marsh horsetail	FACW	Native
Equisetum telmateia	giant horsetail	FACW	Native
Festuca sp.	fescues	---	
Glyceria leptostachya	slim-head manna grass	OBL	Native
Holcus lanatus	common velvet grass	FAC	Eur
Juncus effusus	soft rush	FACW	Native
Juncus sp.	rush	---	
Juncus oxymeris	pointed rush	FACW+	Native
Lotus corniculatus	birdsfoot trefoil	FAC	Eur
Lysichiton americanus	yellow skunk-cabbage	OBL	Native
Malus fusca	Pacific crabapple	FACW	Native
Myosotis laxa	small-flowered forget-me-not	OBL	Native
Oenanthe sarmentosa	water-parsley	OBL	Native
Phalaris arundinacea	reed canarygrass	FACW	Nat & Intro
Plantago major	broadleaf plantain	FACU+	Native
Poaceae	grass family	---	---
Polypodiaceae	fern family	---	---
Populus balsamifera	black cottonwood	FAC	Native
Ranunculus repens	creeping butter-cup	FACW	Eur
Rumex conglomeratus	clustered dock	FACW	Eur
Rubus spectabilis	salmonberry	FAC+	Native
Salix lucida	Pacific willow	FACW+	Native
Salix scouleriana	Scouler willow	FAC	Native
Salix sitchensis	Sitka willow	FACW	Native
Scirpus cyperinus	woolgrass	NI	Native
Scirpus microcarpus	small-fruit bulrush	OBL	Native
Scirpus tabernaemontani	soft-stem bulrush	OBL	Native
Solanum dulcamara	climbing nightshade	FAC+	Eur
Stellaria graminea	lesser starwort	FAC-	Intro
Typha latifolia	broad-leaf cattail	OBL	Native

SR 202 Dry Creek, King County, WA

The following report summarizes project activities completed by the Washington State Department of Transportation (WSDOT) Wetland Monitoring Program at the SR 202 Dry Creek mitigation site. A vegetation survey was conducted during the summer of 2000.

Site Information
Two mitigation sites (SR 202 Patterson Creek #2 and SR 202 Dry Creek Re-channelization) provide compensation for impacts from three projects (SR 202 Vicinity SE 8th Street to Vicinity 300th Ave SE Settlement Correction/Channelization - OL-1596, Junction 244th Ave NE Channelization – OL-2259, and NE Ames Lake Road Vicinity – OL-2260)

Site Name	Dry Creek Re-channelization
Project Names	SR 202 Vicinity SE 8th … Settlement Correct, Junction 244th Ave NE Channelization, and NE Ames Lake Road Vicinity
Work Order	C 5302
Permit Number	00-C5468-01
Permitting Agency	WDFW HPA
Location	SR 202 at NE Ames Lake Road, King Co.
Monitoring Period	2000 to 2004
Year of monitoring	1 of 5
2000 Status	Formal
Area of project impact	0.4 ha (0.99 ac)
Type of mitigation	Stream Re-channelization

Management and Sampling Objectives
Monitoring Objectives were developed from fifth year Standards of Success for Objective 2 - Vegetation as described in the *Final Mitigation Plan Vicinity SE 8th St. to Vicinity 300th Ave SE Settlement Correction/Channelization and Junction 244th Avenue NE Channelization, and NE Ames Lake Road Vicinity SR 202* (Ossinger and Tolon 1997). Objectives and Standards of Success were not prepared specifically for the re-channelization project. The standards for the project are excerpted in Appendix E (SR 202 Patterson Creek #2). Success standards, management objectives, and sampling objectives addressed this year are presented below.

Success Standard
Minimum of 80% survival of planted trees and shrubs, with no less than 25% survivorship within each individual species.

Management Objective 1
Achieve 80% survival of planted tree and shrub species at the SR 202 Dry Creek mitigation site in year 2000. Survival will be 25% or greater for each planted species.

Methods
A total census of planted species was conducted in the upland area (Appendix A, Table 1), and a list of species observed in the stream-bed was recorded (Appendix A, Table 2). Vigor of the bank re-vegetation was noted.

Results
Upland Planted Area: This site was planted in February 1999. In mid-September 2000, woody species survival was 88% for the planted areas of the site. A list of identifiable planted species with individual survival percentages is included in Appendix F, Table 1.

Stream Vegetation: Survival in the stream bank fascines is generally good, with just three areas of poor survival along the left bank totaling approximately 25m length. At the south end of the stream, *Symphoricarpos albus* (snowberry) fascines were in good condition. *Phalaris arundinacea* (reed canarygrass) provided less than 5% cover in the stream-bed based on ocular estimates. A list of plants observed in the stream-bed is included in Appendix F, Table 2.

In general, invasive species were low and the site was in good condition.

Management Activities
Plants were hand watered and weeds were hand-pulled around individual plants this summer. In addition, several *Buddleia* sp. (butterfly bush) were hand pulled from streambed.

Literature Cited

Ossinger, M., and Tolon, M. 1997. Final Mitigation Plan Vicinity SE 8th St. to Vicinity 300th Ave SE Settlement Correction/Channelization and Junction 244th Avenue NE Channelization, and NE Ames Lake Road Vicinity SR 202. Washington State Department of Transportation, Environmental Affairs Office, Olympia WA.

Reed, P. B. Jr. 1993. Supplement to List of Plant Species that Occur in Wetlands: Northwest Region (Region 9). U. S. Fish and Wildlife Service Supplement to Biological Report 88 (26.9).

United States Army Corps of Engineers. 1996. Department of the Army Permit Number 96-4-00944.

Appendix F

Table 1 - SR 202 Dry Creek 2000 Census of Planted Woody Species

**Species Name	Status	Origin	*Survival (%)
Acer macrophyllum	FACU	Native	100
Cornus sericea	FACW	Native	100
Fraxinus latifolia	FACW	Native	100
Pseudotsuga menziesii	FACU	Native	100
Rubus spectabilis	FAC+	Native	100
Salix lucida	FACW+	Native	100
Sambucus racemosa	FACU	Native	88
Salix sitchensis	FACW	Native	100
Symphoricarpos albus	FACU	Native	99
Thuja plicata	FAC	Native	100
Alnus rubra	FAC	Native	100

*Sixty-five unidentifiable dead plantings are not included in the above survival calculations.

***Populus balsamifera* individuals observed were assumed to be volunteers.

Table 2 - SR 2020 Dry Creek 2000 - List of volunteer plants in the streambed

Species Name	Status	Origin
Agrostis alba	FAC	Eur
Agrostis capillaris	FAC	Eurasia
Alnus rubra	FAC	Native
Buddleja davidii	NL	Ornamental
Carex sp.	---	---
Carex stipata	OBL	Native
Cirsium vulgare	FACU	Eur
Echinochloa crusgalli	FACW	Eurasia
Epilobium ciliatum	FACW-	Native
Equisetum sp.	FAC-OBL	---
Festuca rubra	FAC+	Native
Geum macrophyllum	FACW-	Native
Gnaphalium uliginosum	NL	Eur
Juncus acuminatus	OBL	Native
Juncus effusus	FACW	Native
Lolium perenne	FACU	Eur
Mentha sp.	---	---
Mimulus sp.	---	---
Myosotis laxa	OBL	Native
Phalaris arundinacea	FACW	Native and Intro
Plantago major	FACU+	Native
Polygonum persicaria	FACW	Intro
Ranunculus repens	FACW	Eur
Rubus spectabilis	FAC+	Native
Rubus ursinus	FACU	Native
Rumex crispus	FAC+	Intro
Salix lucida	FACW+	Native
Salix sitchensis	FACW	Native
Senecio jacobaea	FACU	Eur
Solanum dulcamara	FAC+	Eur
Trifolium hybridum	FAC	Intro
Trifolium pratense	FACU	Eur
Trifolium repens	FAC	Eur
Veronica americana	OBL	Native

SR 203 Morris Creek, King County

The following report summarizes project activities completed by the Washington State Department of Transportation (WSDOT) Wetland Monitoring Program at the SR 203 Morris Creek mitigation site during the summer 2000. Site activities include surveys of woody and herbaceous vegetation.

Site Information
Two mitigation sites (SR 203 Morris Creek and SR 203 Harris Creek) provide compensation for impacts from the SR 203 Vicinity NE 77th project.

Site Name	Morris Creek
Project Names	SR 203 Vicinity NE 77th
Work Order	MS 4073
Permit Number	95-4-01134 (NWP 23)
Permitting Agency	USACOE
Location	SR 203 near NE 77th and Stillwater Hill Road, King Co.
Monitoring Period	2000 to 2004
Year of monitoring	1 of 5
Area of project impact	0.78 ha (1.93 ac)
Type of mitigation	Category II and III Enhancements
Mitigation Ratios	1/2:1, and 1/5:1
Area of mitigation	1.83 ha (4.52 ac)

Management and Sampling Objectives
Management and sampling objectives were developed from first year standards of success described in the *Final Mitigation Plan Vicinity NE 77th St.* (Ossinger 1997). The complete text of the success standards for this project is listed in Appendix G. Success standards, management objectives, and sampling objectives addressed this year are presented below.

Success Standard
Minimum 80% survival of planted individuals, with no less than 25% survivorship of each individual species.

Management Objective 1
Achieve 80% survival of planted woody species in the palustrine forested zone, with no less than 25% survival for each individual species at the SR 203 Morris Creek mitigation site in 2000.

Sampling Objective 1
To be 80% confident that the survival estimate is within 20% of the true value for each species.

Success Standard
The aerial cover of reed canarygrass in the enhancement area will not exceed 15%.

Management Objective 2
Limit the aerial cover of *Phalaris arundinacea* (reed canarygrass) in the palustrine forested zone and the emergent zone at the SR 203 Morris Creek mitigation site to less than 15% aerial cover from 2000 through 2004.

Sampling Objective 2
To be 80% confident that the aerial cover estimates for *Phalaris arundinacea* in the palustrine forested zone and the emergent zone are within 20% of the true values.

Methods
Using a systematic random sampling method, 20 transects were located in the palustrine forested zone. Survival data for each planted woody species was obtained from 1-m wide quadrats positioned lengthwise along each of the transects. Individual trees and shrubs were evaluated as alive or dead in each quadrat.

Fourteen transects were located in the emergent/scrub-shrub zone using a similar method. The point intercept technique (Bonham 1989; Elzinga et al. 1998) was used to collect aerial cover data for herbaceous species along each sampling transect. Following a random start, point quadrats were systematically placed along each transect in both macroplots. At each point location, a pin flag was lowered vertically from above the tallest herbaceous vegetation on the south side of the transect tape. Each plant species intercepted by the pin flag was recorded. If the pin did not intercept vascular plant species, data was recorded as bare soil, non-vascular plant, or habitat structure.

Data were obtained from 29 sample units in the emergent/scrub-shrub zone. These data were evaluated to obtain a mean aerial cover estimate of *P. arundinacea* in these areas. The following sample size equation was used to evaluate the number of sampling units required to attain the sampling objectives above.

$$n = \frac{(z)^2(s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[1]
n = unadjusted sample size

Results

The estimated survival for all woody species was 98% (CI 0.95 ± 0.05). Survival was estimated at 100% (CI 0.95 ± 0.05) for the all planted species except *Thuja plicata* (western red cedar). *Thuja plicata* survival was estimated at 93% (CI 0.95 ± 0.10). This satisfies the requirement for a minimum of 25% survival of each planted species.

Analysis of point intercept data indicates that the aerial cover provided by *P. arundinacea* in the palustrine emergent/scrub-shrub zone is 49% (0.90 ± 0.15). This estimate exceeds the 15% threshold specified in the mitigation plan (Ossinger 1996). A qualitative estimate of the aerial cover provided by *P. arundinacea* in the forested zone is 5%. This estimate is less than the 15% threshold specified in the mitigation plan. Appendix G includes a list of plant species recorded during our 2000 site visit.

Management Activities

Regional staff have been notified of the high cover provided by *P. arundinacea* and are evaluating weed control measures. In addition, woody species are being installed during the winter of 2000/2001.

Table 1. In the palustrine forested zone, the survival estimate for planted woody species. In the emergent/shrub-scrub zone, cover provided by *Phalaris arundinacea* exceeds the 15% threshold indicated in management objective two.

SR 203 Morris Creek	**Survival (Management Objective 1)**	***Phalaris arundinacea* (Management Objective 2)**
Estimate PFO	98%	5% Aerial Cover (qualitative)
Estimate EM/SS	--	49% (0.90 ± 0.15)
Management Objective	80%	15%
Dominant Species	*Salix* species	
	Alnus rubra	

[1] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

Literature Cited

Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

Canfield, R. H. 1941. Application of the Line Intercept Method in Sampling Range Vegetation. J. For. 39:388-394.

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Reed, P. B. Jr. 1993. Supplement to List of Plant Species that Occur in Wetlands: Northwest Region (Region 9). U. S. Fish and Wildlife Service Supplement to Biological Report 88 (26.9).

Washington State Department of Transportation. 1999. SR 203 Vicinity NE 77th Street Supplement #1 to Final Wetland Mitigation Plan.

Washington State Department of Fisheries. 1997. Hydraulic Project Approval 00-C5769-02. 3 pages.

Appendix G

The following excerpt is from the *SR 203 Vicinity NE 77th Final Wetland Mitigation Plan* (Ossinger 1996). The same goals, objectives, and standards apply to the SR 203 Harris Creek mitigation site. The standards addressed this year are identified in **bold** font. Other standards will be addressed during the monitoring year specified in the standards of success.

Goals: The goal of this project is to restore natural plant communities and historical wetland types to two highly disturbed wetlands, thereby compensating for wetland functions lost due to project impacts. This will be achieved by enhancing existing wet pasture and farmland in the project area. Enhancement will increase ecological diversity by increasing the number of plant and animal species and communities that occupy these areas. Higher structural and species diversity will increase the food-chain support function of the wetlands. As the plant communities mature, so will the soil mature as it is left undisturbed and allowed to accumulate organic matter and fine sediments. These changes cause an increased capacity for the wetlands to provide flood storage and stream base flow support. Increased base flow support and food chain support will benefit salmonid habitat in the adjacent streams.

Objective 1: Establish Native Vegetation
Establish a variety of native trees, shrubs, and herbaceous species.

Standard of Success:

Year 1:

- **Minimum 80% survival of planted individuals, with no less than 25% survivorship of each individual species.**

Year 3:

- Minimum 60% survival of planted individuals, with no fewer than 75% of the total number of planted species remaining. (i.e if 20 species are planted, at least 15 of those species will be present onsite after 3 years.)

Year 5:

- Evident zonation in the enhancement area, with emergent, scrub-shrub, and forested wetland (dominated by tree species, although individuals may be less than 6m tall) represented.

Objective 2: Reed Canarygrass Control
Reduce occurrence of reed canarygrass in mitigation area C (Morris Creek) and prevent its encroachment in to area A (Harris Creek).

Standard of Success:

Years 1, 3, and 5:

- **The aerial cover of reed canarygrass in both enhancement areas will not exceed 15%.**

Contingency Plans

Planted Vegetation

If stem counts reveal that standards of success for planted vegetation are not met, remedial action will take place after the cause of failure has been determined. Remedial action may include replanting with more of the original species and/or replanting with different native species.

Reed Canarygrass

If the cover of reed canarygrass exceeds that specified in the standards of success, control measures will be implemented involving the most effective means available, which may include physical, chemical or mechanical control.

Additional Permit Requirements

The Hydraulic Project Approval 00-C5769-02, issued February 12, 1997 includes the following points:

- 21. Nondesirable and/or invasive vegetation shall be removed. The method of removal shall be by hand or mechanical means unless herbicides are specifically approved.
- 23. Monitoring, maintenance and replacement of the vegetation shall be conducted as necessary to assure 80% survival after 3 years.
- 24. An analysis of how the mitigation site is functioning compared to the preproject goals shall be conducted after 3 years. If the goals are not being met, additional mitigation shall be conducted as necessary to achieve those goals. The additional mitigation shall be conducted within 1 year of the third year analysis.

SR 203 Morris Creek Plant List 2000

Scientific Name	Common Name	Status	Origin
Agrostis alba	redtop	FAC	Eur
Agrostis capillaris	colonial bentgrass	FAC	Eurasia
Alisma plantago-aquatica	broadleaf water-plantain	OBL	Intro
Alnus rubra	red alder	FAC	Native
Alopecurus geniculatus	water foxtail	OBL	Intro
Alopecurus pratensis	meadow foxtail	FACW	Eur
Bidens frondosa	devil's beggarticks	FACW+	Native
Callitriche sp.	water star-worts	---	---
Carex stipata	sawbeak sedge	OBL	Native
Cornus sericea	red-osier dogwood	FACW	Native
Echinochloa crusgalli	large barnyard grass	FACW	Eurasia
Eleocharis ovata	ovate spikerush	OBL	Native
Eleocharis palustris	common spikerush	OBL	Native
Epilobium angustifolium	fireweed	FACU+	Native
Epilobium ciliatum	hairy willow-herb	FACW-	Native
Equisetum arvense	field horsetail	FAC	Native
Equisetum fluviatile	water horsetail	OBL	Native
Equisetum sp.	horsetail	FAC-OBL	
Fraxinus latifolia	Oregon ash	FACW	Native
Holcus lanatus	common velvet grass	FAC	Eur
Impatiens capensis	jewelweed	FACW	Native
Impatiens noli-tangere	western touch-me-not	FACW	Native
Juncus acuminatus	tapertip rush	OBL	Native
Juncus effusus	soft rush	FACW	Native
Juncus tenuis	slender rush	FACW-	Native
Leersia oryzoides	rice cutgrass	OBL	Native
Lolium perenne	perennial ryegrass	FACU	Eur
Ludwigia palustris	marsh seedbox	OBL	Native
Parentucellia viscosa	yellow parentucellia	FAC-	Intro
Phalaris arundinacea	reed canarygrass	FACW	Nat & Intro
Physocarpus capitatus	Pacific ninebark	FACW-	Native
Phleum pratense	common timothy	FAC-	Intro
Picea sitchensis	Sitka spruce	FAC	Native
Plantago lanceolata	English plantain	FAC	Eur
Plantago major	broadleaf plantain	FACU+	Native
Polypodiaceae	ferns	---	---
Ranunculus repens	creeping butter-cup	FACW	Eur

SR 203 Morris Creek Plant List 2000 (continued)			
Scientific Name	**Common Name**	**Status**	**Origin**
Rorippa islandica	bog yellow-cress	NL	Intro
Rosa pisocarpa	peafruit rose	FAC	Native
Rubus armeniacus	Himalayan blackberry	FACU	Eur
Rubus laciniatus	evergreen blackberry	FACU+	Eur
Rubus spectabilis	salmonberry	FAC+	Native
Rumex crispus	curly dock	FAC+	Intro
Salix lucida	Pacific willow	FACW+	Native
Salix scouleriana	Scouler willow	FAC	Native
Salix sitchensis	Sitka willow	FACW	Native
Salix sp.	willows	---	
Solanum dulcamara	climbing nightshade	FAC+	Eur
Sparganium angustifolium	narrowleaf burreed	OBL	Native
Spiraea douglasii	Douglas' spiraea	FACW	Native
Symphoricarpos albus	common snowberry	FACU	Native
Thuja plicata	western red cedar	FAC	Native
Trifolium hybridum	alsike clover	FAC	Intro
Trifolium pratense	red clover	FACU	Eur
Trifolium repens	white clover	FAC	Eur
Typha latifolia	broad-leaf cattail	OBL	Native
Veronica americana	American speedwell	OBL	Native
Vicia tetrasperma	slender vetch	NL	Eur

SR 203 Harris Creek, King County

The following report summarizes project activities completed by the Washington State Department of Transportation (WSDOT) Wetland Monitoring Program at the SR 203 Harris Creek mitigation site during the summer 2000. Site activities include surveys of woody and herbaceous vegetation.

Site Information
Two mitigation sites (SR 203 Morris Creek and SR 203 Harris Creek) provide compensation for impacts from the SR 203 Vicinity NE 77th project.

Site Name	Harris Creek
Project Names	SR 203 Vicinity NE 77th
Work Order	MS 4073
Permit Number	95-4-01134 (NWP 23)
Permitting Agency	USACOE
Location	SR 203, Vicinity NE 77th and Stillwater Hill Road, King Co.
Monitoring Period	2000 to 2004
Year of monitoring	1 of 5
Area of project impact	0.78 ha (1.93 ac)
Type of mitigation	Category II and III Enhancements
Mitigation Ratios	1/2:1, and 1/5:1
Area of mitigation	1.48 ha (3.66 ac)

Management and Sampling Objectives
Management and sampling objectives were developed from first year Standards of Success described in the *Final Mitigation Plan Vicinity NE 77th St.* (Ossinger 1996). The complete text of the success standards for this project is listed in Appendix G (SR 203 Morris Creek report). Success standards, management objectives, and sampling objectives addressed this year are presented below.

Success Standard
Minimum 80% survival of planted individuals, with no less than 25% survivorship of each individual species.

Management Objective 1
Achieve 80% survival of planted woody species at the SR 203 Harris Creek mitigation site, with no less than 25% survival for each individual species in 2000.

Sampling Objective 1
To be 80% confident that the survival estimate is within 20% of the true value for each species.

Success Standard
The aerial cover of reed canarygrass in the enhancement area will not exceed 15%.

Management Objective 2
Limit the aerial cover of *Phalaris arundinacea* (reed canarygrass) at the SR 203 Harris Creek mitigation site to less than 15% aerial cover from 2000 through 2004.

Sampling Objective 2
To be 80% confident that the cover estimate for *Phalaris arundinacea* is within 20% of the true value.

Methods
Using a systematic random sampling method, 16 transects were located on the site. Survival data for each planted woody species was obtained from 1-m wide quadrats positioned length-wise along each of the transects. Individual trees and shrubs were evaluated as alive or dead in each quadrat.

The point intercept technique (Bonham 1989; Elzinga et al. 1998) was used to collect aerial cover data for herbaceous species along each sampling transect. Following a random start, point quadrats were systematically placed along each transect in both macroplots. At each point location, a pin flag was lowered vertically from above the tallest herbaceous vegetation on the south side of the transect tape. Each plant species intercepted by the pin flag was recorded. If the pin did not intercept vascular plant species, data was recorded as bare soil, non-vascular plant, or habitat structure.

Data were obtained at 319 points at this site. Point data was evaluated to obtain an estimate of mean aerial cover of *P. arundinacea*. The following sample size equation was used to evaluate the number of sampling units required to attain the sampling objectives above.

$$n = \frac{(z)^2(s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[1]
n = unadjusted sample size

[1] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

Results
The estimated overall survival for woody species was 99% (CI 0.95 ± 0.05). Survival was estimated at 100% (CI 0.95 ± 0.05) for all species except *Salix sitchensis* (Sitka willow). *S. sitchensis* survival was estimated at 96% (CI 0.95 ± 0.05). This satisfies the requirement for a minimum of 25% survival of each planted species.

Analysis of point intercept data indicates that the estimated mean aerial cover provided by *P. arundinacea* is 20% (CI 0.90 ± 0.20), slightly more than the 15% threshold specified in management objective two. Appendix H includes a list of plant species recorded during our 2000 site visit.

Management Activities
Additional woody species are being installed during the winter of 2000/2001.

Table 1. The estimate of survival for planted woody species meets the management objective. The estimate for cover provided by *Phalaris arundinacea* does not meet management objective.

SR 203 Harris Creek	**Survival (Management Objective 1)**	***Phalaris arundinacea* Aerial Cover (Management Objective 2)**
Result	99% all species	20% (CI 0.90 ± 0.20)
Management Objective	80%	15%
Dominant Species	*Alnus rubra*	*Alopecurus geniculatus*
	Salix species	*Agrostis alba*
	Populus balsamifera	*Phalaris arundinacea*

Literature Cited

Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

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Appendix H

SR 203 Harris Creek Plant List 2000

Species Name	Common Name	Status	Origin
Agrostis alba	redtop	FAC	Eur
Agrostis capillaris	colonial bentgrass	FAC	Eurasia
Alnus rubra	red alder	FAC	Native
Alopecurus geniculatus	water foxtail	OBL	Intro
Carex stipata	sawbeak sedge	OBL	Native
Cornus sericea	red-osier dogwood	FACW	Native
Crepis capillaris	smooth hawk's-beard	FACU	Intro
Eleocharis ovata	ovate spikerush	OBL	Native
Eleocharis palustris	common spikerush	OBL	Native
Epilobium ciliatum	hairy willow-herb	FACW-	Native
Epilobium sp.	willow-herb	---	
Equisetum arvense	field horsetail	FAC	Native
Fraxinus latifolia	Oregon ash	FACW	Native
Geranium molle	dovefoot geranium	NL	Eur
Geranium sp.	crane's bill	---	
Glyceria leptostachya	slim-head manna grass	OBL	Native
Glyceria occidentalis	northwestern manna grass	OBL	Native
Holcus lanatus	common velvet grass	FAC	Eur
Juncus acuminatus	tapertip rush	OBL	Native
Juncus bufonius	toad rush	FACW	Native
Juncus effusus	soft rush	FACW	Native
Juncus ensifolius	dagger-leaf rush	FACW	Native
Juncus tenuis	slender rush	FACW-	Native
Lolium multiflorum	Italian ryegrass	NL	Eur
Lolium perenne	perennial ryegrass	FACU	Eur
Phalaris arundinacea	reed canarygrass	FACW	Nat & Intro
Physocarpus capitatus	Pacific ninebark	FACW-	Native
Picea sitchensis	Sitka spruce	FAC	Native
Plantago lanceolata	English plantain	FAC	Eur
Populus balsamifera	black cottonwood	FAC	Native
Ranunculus repens	creeping butter-cup	FACW	Eur
Rosa sp.	Rose	---	
Rubus armeniacus	Himalayan blackberry	FACU	Eur
Rubus spectabilis	salmonberry	FAC+	Native
Salix lucida	Pacific willow	FACW+	Native

Salix scouleriana	Scouler willow	FAC	Native
Salix sitchensis	Sitka willow	FACW	Native
Sambucus racemosa	red elderberry	FACU	Native
Scirpus microcarpus	small-fruit bulrush	OBL	Native
Solanum dulcamara	climbing nightshade	FAC+	Eur
Sonchus asper	prickly sowthistle	FAC-	Intro
Thuja plicata	western red cedar	FAC	Native
Trifolium dubium	suckling clover	UPL	Intro
Trifolium hybridum	alsike clover	FAC	Intro
Trifolium repens	white clover	FAC	Eur
Veronica americana	American speedwell	OBL	Native

SR 405 Swamp Creek, King County

The following report summarizes project activities completed by the Washington State Department of Transportation (WSDOT) Wetland Monitoring Program at the SR 405 Swamp Creek wetland mitigation site in August 2000. Quantitative monitoring activities included an aerial cover survey of tree and shrub species. Qualitative data were also collected for herbaceous vegetation and wildlife.

Site Information

Site Name	SR 405 Swamp Creek
Project Name	SR 405 Bothell to Swamp Creek I/C
Permit Number	94-4-01739
Permitting Agency	USACE
Location	King County, Washington
Township/Range/Section	T26N R5E S4,5,8,9
Monitoring Period	1999-2003
Year of Monitoring	2 of 3
Area of Project Impact	0.05 ha (0.13 ac)
Type of Mitigation	Wetland creation
Area of Mitigation	0.17 ha (0.24 ac)

Management and Sampling Objectives

The second year monitoring objective for the Swamp Creek mitigation project was developed from requirements described in the *Hydraulic Project Approval* (WSDFW 1997), and *City of Bothell Shoreline Management Act Conditional Use Permit* (City of Bothell 1996). The pertinent text of the permits for this project is presented in Appendix I. Success standards, management objectives, and sampling objectives addressed this year are presented below.

Success Standard
Obtain a minimum shrub coverage of 85% surface cover within 2 years of planting.

Management Objective

Achieve 85% or greater aerial cover of tree and shrub species at the SR 405 Swamp Creek mitigation site in year 2000.

Sampling Objective

To be 80% confident the mean aerial cover estimate for tree and shrub species is within 20% of the true cover value.

Methods

A sampling macroplot was strategically positioned to include all vegetation zones at the Swamp Creek mitigation site. Following a random start, transects were located using a systematic random sampling method. Transects were extended perpendicular to a 90-m baseline at the northern site boundary and across the site to the southern boundary. Both herbaceous and woody species cover data were collected along sampling transects.

Cover data for the woody species plant community was collected using the line-intercept method (Canfield 1941; Bonham 1989). All woody vegetation intercepting tape measures stretched along each sampling transect was identified and the length of the canopy intercept was recorded. To achieve the statistical confidence interval specified in sampling objective one, 38 sampling units were randomly located along sampling transects.

For the herbaceous community, the point intercept technique (Bonham 1989; Elzinga et al. 1998) was used to collect aerial cover data for plant species. Following a random start, point quadrats were systematically placed along sampling transects through all vegetative zones. At each point location, a rod was dropped vertically from above the tallest herbaceous vegetation. All plant species touched by the rod were recorded. If the rod touched no vascular plant species, the data was recorded as bare soil, non-vascular plant, or habitat structure.

The following sample size equation was used to evaluate the number of sample units required to attain the sampling objective.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[1]
n = unadjusted sample size

Four bird surveys were conducted at the mitigation site from May through July. The point count method (Ralph et al. 1993) was used to document species presence and relative abundance.

[1] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

Results and Discussion

Data analysis shows planted areas of the mitigation site support 37% aerial cover (CI 0.80 ± 0.20) of native forest and scrub-shrub species (Table 1). While this value does not achieve the 85% cover requirement in management objective one, qualitative observations report high survival and satisfactory development of trees and shrubs in all vegetative zones.

Appendix I includes a list of native woody shrub species recorded during monitoring visits to the SR 405 Swamp Creek mitigation site in 2000.

Point quadrat data indicate the presence of *Phalaris arundinacea* (reed canarygrass), *Lythrum salicaria* (Purple loosestrife), *Cirsium vulgare* (bull thistle), and *Rubus armeniacus* (Himalayan blackberry) at very low cover levels on the mitigation site.

This year's data record shows the bird community at the Swamp Creek mitigation site is diverse with 22 species from 13 avian families represented. Three wetland dependent species were recorded during bird surveys in 2000. These species were the Common Yellowthroat, Belted Kingfisher, and Red-winged Blackbird (Thomas 1979, Erhlich et al. 1988, Smith et al. 1997). Other species known to use wetlands for feeding, breeding or nesting were observed on site this year, the Barn Swallow, Wilson's Warbler, Black-capped chickadee, and Willow Flycatcher (Thomas 1979, Erhlich et al. 1988, Smith et al. 1997). Adult and juvenile Black-capped Chickadees, Gold Finches, and House Finches were particularly abundant on site during each visit. These data and observations suggest the site is satisfying presence and abundance of wildlife detailed in the Hydraulic Project Approval criteria (WSDF 1997).

Table 1. The cover estimate for native shrub species show the objective has not yet been achieved.

Native Woody Species	Woody Species (Objective 1)
Total Aerial Cover	37%
Management Objective	85%

Literature Cited

Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

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Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Handbook of Field Methods for Monitoring Landbirds. Gen. Tech. Rep. PSW-GTR-144. Albany, CA: Pacific Southwest Research Station, Forest Service, Department of Agriculture.

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Thomas, J. W. (tech ed.). 1979. Wildlife Habitat in Managed Forests – the Blue Mountains of Oregon and Washington. USDA Forest Service, Agricultural Handbook No. 553.

United States Army Corps of Engineers. 1994. Department of the Army Permit. Number 94-4-01739.

Washington State Department of Fisheries. 1997. Hydraulic Project Approval. 00-C5721-02

Appendix I

Regulatory Requirements

Permit requirements from the *Hydraulic Project Approval* include:

- Monitoring is required annually for three years during the growing season. Monitoring is to include vegetation types and densities, and soil conditions. In addition, monitoring is to include presence and abundance of fish and wildlife.
- Establishing permanent photo-points, including a panoramic view and photos of the transects.
- Non-desirable and/or invasive vegetation shall be removed by hand or mechanically unless herbicide is specifically approved.
- Plantings will be maintained as necessary for three years to ensure 80% survival.
- Within one year, the stream banks and mitigation area shall be re-vegetated with native woody species**.**
- An analysis of how the site is functioning compared to the pre-project goals shall be conducted after 3 years.

Permit requirements from the *City of Bothell Shoreline Management Act* include:

- **Obtain a minimum shrub coverage of 85% surface cover within 2 years of planting**.
- Create a minimum of 970 square foot emergent wetland, 9,790 square foot scrub/shrub wetland, and 22,600 square foot upland buffer area.

SR 405 Swamp Creek Native Woody Species List

Species Name	Common Name	Status	Origin
Acer circinatum	Vine maple	FAC-	Native
Rubus laciniatus	Evergreen blackberry	FACU+	EUR
Pseudotsuga menzesii	Douglas fir	FACU	Native
Sambucus racemosa	Red elderberry	FACU	Native
Cornus sericea	red-osier dogwood	FACW	Native
Cytisus scoparius	Scotch broom	UPL	Intro
Rubus armeniacus	Himalayan blackberry	FACU	Eur
Rubus spectabilis	Salmonberry	FAC+	Native
Salix lucida	Pacific willow	FACW+	Native
Populous balsimifera	Black cottonwood	FAC	Native
Physocarpus capitatus	Pacific ninebark	FACW-	Native
Tsuga heteropylla	Western hemlock	FACU-	Native
Salix sitchensis	Sitka willow	FACW	Native

SR 405 Swamp Creek Bird List

Common Name	Scientific Name	Family Name	*Wetland Dependent
American Crow	*Corvus brachyrhynchos*	Corvidae	
American Goldfinch	*Carduelis tristis*	Fringillidae	
American Robin	*Turdus migratorius*	Turdidae	
Barn Swallow	*Hirundo rustica*	Hirundinidae	
Belted Kingfisher	*Ceryle alcyon*	Alcedinidae	X
Black-capped Chickadee	*Parus atricapillus*	Paridae	
Brown-headed Cowbird	*Molothrus ater*	Icteridae	
Cedar Waxwing	*Bombycilla cedrorum*	Bombycillidae	
Cliff Swallow	*Hirundo pyrrhonota*	Hirundinidae	
Common Yellowthroat	*Geothlypis trichas*	Emberizidae	X
Dark-eyed Junco	*Junco hyemalis*	Emberizidae	
European Starling	*Sturnus vulgaris*	Sturnidae	
Glaucous-winged Gull	*Larus glaucescens*	Laridae	
House Finch	*Carpodacus mexicanus*	Fringillidae	
Red-winged Blackbird	*Agelaius phoeniceus*	Icteridae	X
Savannah Sparrow	*Passerculus sandwichensis*	Emberizidae	
Song Sparrow	*Melospiza melodia*	Emberizidae	
Spotted Towhee	*Pipilo maculatus*	Emberizidae	
Violet-green Swallow	*Tachycineta thalassina*	Hirundinidae	
White-crowned Sparrow	*Zonotrichia leucophrys*	Emberizidae	
Willow Flycatcher	*Empidonax traillii*	Tyrannidae	
Wilson's Warbler	*Wilsonia pusilla*	Emberizidae	

** Wetland dependent species are those that are considered restricted in temporal or spatial distribution to wetlands based on an intrinsic feature or features of the environment* (Finch 1989).

SR 516 Bartol, King County

The following report summarizes project activities completed by the Washington State Department of Transportation (WSDOT) Wetland Monitoring Program at the SR 203 Morris Creek mitigation site during the summer 2000. Site activities include surveys of woody and herbaceous vegetation.

Site Information

Site Name	Bartol
Project Names	SR 18 SE 304th Street to Covington Way
Work Order	C 5219
Permit Number	95-4-00203
Permitting Agency	USACOE
Location	North of SR 516 and east of Big Soos Creek, King Co.
Monitoring Period	2000 to 2004
Year of monitoring	3 of 5
Area of project impact	Wetland - 0.7 ha (1.77 ac), Buffer – 0.82 ha (2.05 ac)
Type of mitigation	Creation and Enhancement
Mitigation Ratios	2:1
Area of mitigation	Wetland - 1.19 ha (2.98 ac), Buffer – 0.23 ha (0.58 ac)

Management and Sampling Objectives

Management and sampling objectives were developed from third year standards of success described in the *SR 18 SE 304th Street to Covington Way Wetland Mitigation Plan* (Davis 1994). The complete text of the success standards for this project is listed in Appendix J. Success standards, management objectives, and sampling objectives addressed this year are presented below.

Success Standards

The wetland should have 50% areal coverage of forested and scrub-shrub species.

Management Objective 1

Achieve 50% or greater aerial cover by forested and scrub-shrub species in the wetland portion of the SR 516 Bartol wetland mitigation site in 2000.

Sampling Objective 1

To be 80% confident that the mean aerial cover estimate is within 20% of the true cover value.

Success Standard
Upland buffer area should have 50% cover by forested species planted, or be supplemented or replaced by native naturally colonizing upland forested plant community at 50% or greater cover.

Management Objective 2
Achieve 50% or greater aerial cover in the upland buffer area of the SR 516 Bartol wetland mitigation site by planted and native naturally occurring upland forested species in 2000.

Sampling Objective 2
To be 80% confident that the mean aerial cover estimate is within 20% of the true cover value.

Success Standard
Riparian forested buffer area should have 50% cover by forested species planted, or be supplemented or replaced by native naturally colonizing upland forested plant community at 50% or greater cover.

Management Objective 3
Achieve 50% or greater aerial cover in the riparian buffer area of the SR 516 Bartol wetland mitigation site by planted and native naturally occurring upland forested species in 2000.

Sampling Objective 3
To be 80% confident that the mean aerial cover estimate is within 20% of the true value.

Methods
A temporary macroplot was strategically placed in each of the three ecological zones on the site; wetland, upland buffer and riparian buffer. Within the macroplots, transects were located using a systematic random sampling method. Transects were extended perpendicular to each macroplot baseline.

Cover data for the woody species plant communities were collected using the line-intercept method (Canfield 1941; Bonham 1989). All woody vegetation intercepting a tape measure stretched along each sampling transect was identified and the length of the canopy intercept was recorded. Data were obtained from 25 transects in the wetland, 20 transects in the upland, and 34 transects in the riparian buffer.

The point intercept technique (Bonham 1989; Elzinga et al. 1998) was used to collect aerial cover data for herbaceous species along each of the above sampling transects.

Following a random start, point quadrats were systematically placed along each transect in the macroplots. At each point location, a pin flag was lowered vertically from above the tallest herbaceous vegetation on the south side of the transect tape. Each plant species intercepted by the pin flag was recorded. If the pin did not intercept vascular plant species, data was recorded as bare soil, non-vascular plant, or habitat structure. Data were evaluated to obtain a mean aerial cover estimate of invasive species in these areas. Invasive species were considered to be noxious weeds (Washington State Noxious Weed Control Board 2000).

The following sample size equation was used to analyze the data collected.

$$n = \frac{(z)^2(s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[1]
n = unadjusted sample size

Results

In the wetland, the estimated aerial cover for forested and scrub-shrub species was 28% (CI 0.80 ± 0.22). Dominant species observed in the wetland included *Cornus sericea* (red-osier dogwood), *Lonicera involucrata* (black twinberry), and *Salix* species (willows) (Table 1). Photograph 1 (Appendix J) shows a representative view of the scrub-shrub wetland.

In the upland buffer, the estimated aerial cover for forested and scrub-shrub species was 8% (CI 0.80 ± 0.18). Dominant species observed in the upland buffer included *Cornus sericea* (red-osier dogwood) and *Acer circinatum* (vine maple). In the riparian buffer, the estimated aerial cover for forested and scrub-shrub species was 12% (CI 0.80 ± 0.30).

Dominant species observed in the riparian buffer included *Cornus sericea* (red-osier dogwood), *Rubus armeniacus* (Himalayan blackberry), and *Salix* species (willows). The estimated aerial cover for these macroplots is less than required by the management objectives.

Analysis of point intercept data indicates that the aerial cover provided by invasive species was 21% (CI 0.80 ± 0.17) in the upland buffer macroplot, and 47% (CI 0.80 ± 0.30), in the riparian buffer macroplot. These estimates exceed the 10% threshold specified in the contingency section of the mitigation plan (Davis 1994). The aerial cover provided by invasive species in the wetland was qualitatively estimated to approach this 10% threshold. *Phalaris arundinacea* (reed canarygrass), the single dominant species of

[1] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

the invasive community in the entire site, is a Class C Noxious weed (Washington State Noxious Weed Control Board 2000). Appendix J includes a list of plant species recorded during our 2000 site visit.

Table 1. The estimate of cover provided by scrub-shrub and forested species did not meet the management objectives.

SR 516 Bartol	Wetland Aerial Cover	Upland Buffer Aerial Cover	Riparian Buffer Aerial Cover
S/S and FO Species	28 % (CI 0.80 ± 0.22)	8 % (CI 0.80 ± 0.18)	12 % (CI 0.80 ± 0.30)
Management Objective	50 %	50 %	50 %
Dominant Species	*Cornus sericea*	*Cornus sericea*	*Cornus sericea*
	Lonicera involucrata	*Acer circinatum*	*Salix* species
	Salix species		*Rubus armeniacus*

Table 2. The estimate of cover provided by invasive species in the wetland, upland buffer, and riparian buffer macroplots is greater than the contingency plan threshold.

SR 516 Bartol	Wetland Aerial Cover	Upland Buffer Aerial Cover	Riparian Buffer Aerial Cover
Invasive Species	≅ 10 % qualitative	21 % (CI 0.80 ± 0.17)	48 % (CI 0.80 ± 0.30)
Contingency Plan	< 10 %	< 10 %	< 10 %

Literature Cited

Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

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Davis, G. S. 1994. SR 18 SE 304th Street to Covington Way Wetland Mitigation Plan. Washington State Department of Transportation Northwest Region.

Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management Technical Reference 1730-1, BLM/RS/ST-98/005+1730.

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Washington State Noxious Weed Control Board. 2000. State Noxious Weed List and Schedule of Monetary Penalties. Washington Administrative Code, Chapter 16-750. In: RCW Chapter 17.10. 99-24-029, filed 1999, effective 1/3/00

Appendix J

Photograph 1 – SR 516 Bartol: Representative view of the shrub-scrub zone August 16, 2000.

The following excerpt is from the *SR 18 SE 304th Street to Covington Way Wetland Mitigation Plan* (Davis 1993). The standards addressed this year are identified in **bold** font. Other standards will be addressed during the monitoring year specified in the standards of success.

Goals, Objectives and Standards of Success

The goals for the SR 18 SE 304th Street to Covington Way wetland mitigation project is to create and enhance forested scrub-shrub wetland and buffer as in-kind mitigation for impacts to 0.7 ha (1.77 ac) wetland and 0.82 ha (2.05 ac) of buffer. In general, the created wetland, wetland buffer, and riparian buffer are expected to provide the following functions: fish and wildlife habitat, food chain support, water storage and attenuation, and sediment and nutrient trapping.

Objective #1 – Vegetation

The mitigation sites will include 2.57 ha (6.43 ac) of forested and scrub-shrub wetland and 1 ha (2.5 ac) of wetland buffer. The vegetation planted will provide value as food-chain support, as well as the functions of flood attenuation, and sediment and nutrient trapping as compared to existing site conditions. The riparian vegetation planted along Big Soos Creek will assist in protection and enhancement of in-stream habitat. As this vegetation matures, it will assist in providing shade, winter cover, and recruitment of large organic debris that will be available to enhance in-stream habitat.

Performance Standards:

After three years:

- The forested wetland should have 70% viability of planted species or be supplemented by natural recruitment of native facultative or wetter native wetland species.
- **The wetland should have 50% areal coverage of forested and scrub-shrub species.**

After five years:

- The wetland should have 80% areal cover of forested and scrub-shrub wetland vegetation.

Objective #2 - Wildlife

Wildlife habitat diversity will be increased by additions of native species plantings and from the combination of the establishment of early seral vegetation with the more mature forested vegetation existing at the site. The addition of stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetated areas. Overall, the creation of a forested wetland adjacent to Big Soos Creek will function to increase the value of the existing riparian habitat by providing additional feeding, breeding, and resting habitat for birds, small mammals, and amphibians. The mitigation plan also assists in extending the vegetated corridor available for wildlife movement along Big Soos Creek.

Implementation of the mitigation plan will result in the increase in habitat and edge between habitat types.

Performance Standards:
After three years:

- The forested wetland, wetland buffer, and riparian buffer should have 70% viability of planted tree and shrub species.
- There will be at least four habitat structures (logs, stumps, snags, brush piles) within the boundary of the wetland mitigation site at SR 18 and five habitat structures (logs, stumps, snags, brush piles) within boundary of the wetland mitigation site at SR 516. These structures will provide perches, cover, and habitat diversity as the planted vegetation matures.

After five years:

- Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed.
- The mitigation site should have 80% aerial cover of trees and shrubs.

Objective #3 - Buffers
There will be 0.77 ha (1.91 ac) of forested and scrub-shrub wetland buffer surrounding the created wetland at SR 18 and 0.23 ha (0.58 ac) of forested and scrub-shrub wetland buffer surrounding the created wetland at SR 516.

Performance Standard:
After three years:

- **Upland and riparian forested buffer areas should have 50% cover by forested species planted, or be supplemented or replaced by native naturally colonizing upland forested plant community at 50% or greater cover.**

After five years:

- Upland and riparian forested buffer areas should have 75% cover by forested buffer species planted, or be supplemented or replaced by native naturally colonizing upland forested plant community at 75% or greater cover.

Contingency Plans

1. If the coverage of trees is less than 50% after the third growing season these species will be replanted. Sprigs, cuttings seeds or live plant material will be replanted and monitored to assure that coverage meets performance standard criteria. Remedial work may occur if hydrology is not sufficient to support wetland vegetation.

2. If aerial coverage of wetland plants is less than 50% after the fourth year, resource agencies will be consulted for advice on further measures to remedy the problems at the site. The monitoring program will be extended and such reasonable measures will be performed as are necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland system.
3. The mitigation plan is designed to utilize and promote growth of native vegetation. Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species.

Additional Permit Requirements

DOE #95-4-00203 (page 3):
The annual monitoring report shall address the success of prevention of invasive species, and requires photographs to document success of re-vegetation of the disturbed areas.

SR 516 Bartol Plant List 2000

Species Name	Common Name	Status	Origin
Acer circinatum	vine maple	FAC-	Native
Achillea millefolium	common yarrow	FACU	Native
Agrostis alba	redtop	FAC	Eur
Agrostis capillaris	colonial bentgrass	FAC	Eurasia
Alnus rubra	red alder	FAC	Native
Alopecurus pratensis	meadow foxtail	FACW	Eur
Anthoxanthum odoratum	sweet vernal grass	FACU	Eur
Carex stipata	sawbeak sedge	OBL	Native
Cirsium arvense	Canada thistle	FACU+	Eur
Cirsium vulgare	bull thistle	FACU	Eur
Conium maculatum	poison-hemlock	FAC+	Eur
Cornus sericea	red-osier dogwood	FACW	Native
Crepis capillaris	smooth hawk's-beard	FACU	Intro
Daucus carota	Queen Anne's lace	NL	Eur
Eleocharis palustris	common spikerush	OBL	Native
Elytrigia repens	quackgrass	FAC-	Eurasia
Epilobium angustifolium	fireweed	FACU+	Native
Epilobium ciliatum	hairy willow-herb	FACW-	Native
Equisetum arvense	field horsetail	FAC	Native
Equisetum telmateia	giant horsetail	FACW	Native
Eschscholzia californica	California poppy	NL	Native
Festuca pratensis	meadow fescue	FACU+	Eur
Galium trifidum	small bedstraw	FACW+	Native
Galium triflorum	sweet-scent bedstraw	FACU	Native
Geranium dissectum	cut-leaved geranium	NL	Eur
Glyceria grandis	American mannagrass	NL	Native
Holcus lanatus	common velvet grass	FAC	Eur
Hypochaeris radicata	spotted cat's-ear	FACU	Eur
Juncus effusus	soft rush	FACW	Native
Lactuca serriola	prickly lettuce	FACU	Eur
Leucanthemum vulgare	oxeye-daisy	NL	Native
Lolium multiflorum	Italian ryegrass	NL	Eur
Lolium perenne	perennial ryegrass	FACU	Eur
Lonicera involucrata	black twinberry	FAC+	Native
Lotus corniculatus	birdsfoot trefoil	FAC	Eur
Ludwigia palustris	marsh seedbox	OBL	Native
Mentha aquatica	water mint	NO	Introd

Species Name	Common Name	Status	Origin
Oemleria cerasiformis	Indian plum	FACU	Native
Oenanthe sarmentosa	water-parsley	OBL	Native
Phalaris arundinacea	reed canarygrass	FACW	Nat & Intro
Physocarpus capitatus	Pacific ninebark	FACW-	Native
Plantago lanceolata	English plantain	FAC	Eur
Poa sp.	bluegrasses	---	
Poa trivialis	rough bluegrass	FACW	Intro
Prunus emarginata	bitter cherry	FACU	Native
Prunus sp.	plum, cherry	---	
Ranunculus repens	creeping butter-cup	FACW	Eur
Rhamnus purshiana	cascara	FAC-	Native
Rosa sp.	Rose	---	
Rubus armeniacus	Himalayan blackberry	FACU	Eur
Rubus laciniatus	evergreen blackberry	FACU+	Eur
Rubus parviflorus	western thimbleberry	FAC-	Native
Rubus spectabilis	salmonberry	FAC+	Native
Rumex crispus	curly dock	FAC+	Intro
Salix lucida	Pacific willow	FACW+	Native
Salix scouleriana	Scouler willow	FAC	Native
Salix sitchensis	Sitka willow	FACW	Native
Salix sp.	willows	---	
Sambucus racemosa	red elderberry	FACU	Native
Senecio jacobaea	tansy ragwort	FACU	Eur
Sonchus oleraceus	common sowthistle	UPL	Intro
Spiraea douglasii	Douglas' spiraea	FACW	Native
Tanacetum vulgare	common tansy	NI	Intro
Taraxacum officinale	common dandelion	FACU	Nat-Int
Thuja plicata	western red cedar	FAC	Native
Trifolium pratense	red clover	FACU	Eur
Typha latifolia	broad-leaf cattail	OBL	Native
Veronica americana	American speedwell	OBL	Native
Veronica arvensis	corn speedwell	FACU	Eurasia
Vicia hirsuta	hairy vetch	NL	Eur
Vicia sativa	common vetch	UPL	Intro
Vicia tetrasperma	slender vetch	NL	Eur
Vulpia myuros	rat-tail fescue	FAC	Intro

SR 900 May Valley SW, King County

The following report summarizes project activities completed by the Washington State Department of Transportation (WSDOT) Wetland Monitoring Program at the SR 900 May Valley SW wetland mitigation site in August 2000. Activities include cover surveys of herbaceous and woody vegetation.

Site Information

The May Valley mitigation sites were created as compensation for wetland impacts that occurred during widening and realignment of SR 900 at its junction with May Valley Road in King County. Wetland impacts from the project total 0.73 ha (1.81 ac), with mitigation provided by the May Valley South and May Valley North sites.

Site Name	SR 900 May Valley SW
Project Name	Junction, SE May Valley Road – SR 900
Location	Southwest corner of the intersection, King County
Township/Range/Section	T23N R6E S7
Monitoring Period	1996-2004
Year of Monitoring	5 of 5
Area of Project Impact	0.73 ha (1.81 ac)
Type of Mitigation	Wetland Enhancement and Riparian Enhancement
Area of Mitigation	1.52 ha (3.76 ac) wetland and 0.15 ha (0.37 ac) riparian
Replacement Ratio	2:1 and 4:1

Management and Sampling Objectives

Monitoring objectives for the May Valley SW mitigation site were developed from success standards described in the *Junction, SE May Valley Road, SR 900 Detailed Wetland Mitigation Plan* (Clay-Poole and Savage 1995). The complete text of the success standards for this project is listed in Appendix K. Success standards, management objectives, and sampling objectives addressed this year are presented below.

Success Standard

The wetland has greater than or equal to 80% areal cover of facultative or wetter plants.

Management Objective 1

Achieve 80% aerial cover of facultative and wetter (Reed 1993) woody species in the wetland area of the SR 900 May Valley SW mitigation site by 2000.

Sampling Objective 1

To be 80% confident the estimated mean aerial cover of facultative and wetter woody species in the wetland area is within 20% of the true cover value.

Success Standard
The scrub-shrub/ forested zone has greater than or equal to 35% areal cover of planted tree and shrub species as listed in Table 5, or of native tree or shrub species through natural recruitment.

Management Objective 2
Achieve 35% aerial cover of planted or naturally occurring native woody species in the wetland area of the SR 900 May Valley SW mitigation site by 2000. [1]

Sampling Objective 2
To be 80% confident the estimated mean aerial cover of planted or naturally occurring native woody species in the wetland area is within 20% of the true cover value.

Success Standard
Non-native species will comprise less than 15% of the wetland vegetation.

Management Objective 3
Limit non-native species to less than 15% of the total species in the wetland area of the SR 900 May Valley mitigation site by 2000.

Sampling Objective 3
To be 80% confident the mean aerial cover estimate of invasive exotic species is within 20% of the true cover value.

Success Standard
The riparian zone has greater than or equal to 80% areal cover of facultative or wetter plants.

Management Objective 4
Achieve 80% aerial cover of facultative and wetter woody species in the riparian area of the SR 900 May Valley SW mitigation site by 2000.

Sampling Objective 4
To be 80% confident the estimated mean aerial cover of facultative and wetter woody species in the riparian area is within 20% of the true cover value.

[1] Planted species are listed in Figure 4 of the mitigation plan for this site (Clay-Poole and Savage 1995). Table 4 can be found Appendix L.

Success Standard
The riparian zone has greater than or equal to 35% areal cover of planted tree and shrub species as listed in Table 5, or of native tree or shrub species through natural recruitment.

Management Objective 5
Achieve 35% aerial cover of planted or naturally occurring native woody species in the riparian area of the SR 900 May Valley SW mitigation site by 2000.

Sampling Objective 5
To be 80% confident the estimated mean aerial cover of planted or naturally occurring native woody species in the riparian area is within 20% of the true cover value.

Success Standard
The forest zone has greater than or equal to 80% areal cover of facultative or wetter plants.

Management Objective 6
Achieve 80% aerial cover of facultative and wetter woody species in the forest zone of the SR 900 May Valley mitigation site by 2000.

Sampling Objective 6
To be 80% confident the estimated mean aerial cover of facultative or wetter woody species in the forest zone is within 20% of the true cover value.

Success Standard
The forest zone has greater than or equal to 25% areal cover of planted tree and shrub species as listed in Table 5, or of native tree or shrub species through natural recruitment.

Management Objective 7
Achieve 25% aerial cover of planted or naturally occurring native woody species in the forest zone of the SR 900 May Valley SW mitigation site by 2000.

Sampling Objective 7
To be 80% confident the estimated mean aerial cover of planted or naturally occurring native woody species in the forest zone is within 20% of the true cover value.

Success Standard
The mitigation plan is designed to utilize and promote the growth of native vegetation. Noxious weeds, such as purple loosestrife or tansy will be eliminated within that growing season of found on the site. A weed control program will be implemented if more than 20% of the wetland cover is comprised of invasive exotic species.

Management Objective 8
Limit the aerial cover of exotic invasive species to less than 20% on the SR 900 May Valley SW mitigation site in 2000.

Sampling Objective 8
To be 80% confident the estimated mean aerial cover value of exotic invasive species is within 20% of the true cover value.

Methods
Biologists strategically placed a baseline at the transition between the wetland and riparian zones. This 86-m baseline ran roughly east to west. One macroplot (15m x 86m) was established south of the baseline in the riparian area. A second macroplot (70m x 86m) was placed north of the baseline within the wetland area of the site. In both macroplots, 20 transects were located perpendicular to the baseline using a systematic random sampling method. Using the same method, an additional 19 transects were located in the forest zone adjacent to May Valley Road and SR 900 with the fence serving as a baseline. Data were collected for both herbaceous and woody plant species.

The point intercept technique (Bonham 1989; Elzinga et al. 1998) was used to collect aerial cover data for herbaceous species along each sampling transect. Following a random start, point quadrats were systematically placed along each transect in each macroplot. At each point location, a pin flag was lowered vertically from above the tallest herbaceous vegetation on the south side of the transect tape. Each plant species intercepted by the pin flag was recorded. If the pin did not intercept vascular plant species, data was recorded as bare soil, non-vascular plant, or habitat structure.

Cover data for the woody species plant communities were collected using the line-intercept method (Canfield 1941; Bonham 1989). All woody vegetation intercepting a tape measure stretched along each sampling transect was identified and the length of the canopy intercept was recorded.

The following sample size equation was used to analyze all data collected.

$$n = \frac{(z)^2(s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[2]
n = unadjusted sample size

Results and Discussion

Twelve species of woody plants were identified in the wetland area of the site in 2000. With the exception of two *Rubus* spp. (blackberries), they all have an indicator status of facultative or wetter (Reed 1993) and are native to the Pacific Northwest. As shown in Table 1, the aerial cover provided by this desirable group of trees and shrubs is 58% (CI 0.90 ± 0.15) (management objectives 1 and 2). The two non-native *Rubus* species account for 17% of the total woody species encountered (management objective 3).

The riparian area of this site has developed into a thicket of woody plants. Dominant species include *Alnus rubra* (red alder), *Cornus sericea* (red-osier dogwood), and *Salix sitchensis* (Sitka willow). The native species present in the riparian area all have an indicator status of facultative or wetter. As shown in Table 2, this plant community provides 94% (CI 0.99 ± 0.10) aerial cover in the riparian area (management objectives 4 and 5).

In the forested area, native woody species afford 63% (CI 0.80 ± 0.20) aerial cover (management objective 6) (Table 3). Facultative and wetter species provide 49% (CI 0.80 ± 0.26) aerial cover in the forested area (management objective 7). Commonly occurring species include *Alnus rubra* (red alder), *Physocarpus capitatus* (Pacific ninebark), and *Rubus spectabilis* (salmonberry). Appendix K contains a complete list of woody species found in all areas of this site.

The herbaceous plant community is dominated by *Phalaris arundinacea* (reed canarygrass), a state listed Class C Noxious Weed (Washington State Noxious Weed Control Board 2000). This species provides 38% (CI 0.80 ± 0.30) aerial cover in the forested area, 69% aerial cover (CI 0.80 ± 0.335) in the riparian area, and 72% (CI 0.90 ± 0.15) in the wetland area (management objective 8). Other exotic invasive species found on-site include *Rubus armeniacus* (Himalayan blackberry) and *Rubus laciniatus* (evergreen blackberry).

Management Activities

Regional staff has been informed of the status of this site. Plans for appropriate remedial action are currently being developed.

[2] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

Table 1. Cover estimates for woody species show objectives have been achieved for FAC and wetter species in the Wetland Area, but not achieved for native species.

SR 900 May Valley SW	Wetland Area Woody Species	
	Native Species (Objective 1)	FAC and Wetter Species (Objective 2)
Aerial Cover	58 %	58 %
Management Objective	80 %	35 %
Dominant Species	*Cornus sericea*	
	Salix sitchensis	
	Fraxinus latifolia	

Table 2. Cover estimates for woody species show objectives have been achieved for both native and FAC and wetter species in the Riparian Area.

SR 900 May Valley SW	Riparian Area Woody Species	
	Native Species (Objective 4)	FAC and Wetter Species (Objective 5)
Aerial Cover	94 %	94 %
Management Objective	80 %	35 %
Dominant Species	*Alnus rubra*	
	Cornus sericea	
	Salix sitchensis	

Table 3. Cover estimates for woody species show objectives have been achieved for FAC and wetter species in the Forested Areas, but not achieved for native species.

SR 900 May Valley SW	Forested Area Woody Species	
	Native Species (Objective 6)	FAC and Wetter Species (Objective 7)
Aerial Cover	63 %	49 %
Management Objective	80 %	35 %
Dominant Species	*Alnus rubra*	
	Physocarpus capitatus	
	Rubus spectabilis	

Literature Cited

Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley & Sons, New York, NY.

Canfield, R. H. 1941. Application of the Line Intercept Method in Sampling Range Vegetation. J. For. 39:388-394.Clay-Poole S. T. and M. S. Savage. 1995. Junction, SE May Valley Road, SR 900 Detailed Wetland Mitigation Plan (original April 1994, Modified March 1995). Washington State Department of Transportation Headquarters, Olympia.

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Washington State Noxious Weed Control Board. 2000. State Noxious Weed List and Schedule of Monetary Penalties. Washington Administrative Code, Chapter 16-750. In: RCW Chapter 17.10. 99-24-029, filed 1999, effective 1/3/00.

Appendix K

The following excerpt is from the *Junction, SE May Valley Road SR 900 Detailed Wetland MitigationPlan* (Clay-Poole and Savage 1995). The standards addressed this year are identified in **bold** font.

Table 4. Planting List

Scrub-Shrub Forest Zone			
Pacific ninebark	*Physocarpus capitatus*	black cottonwood	*Populus balsamifera*
Oregon ash	*Fraxinus latifolia*	salmonberry	*Rubus spectabilis*
western red cedar	*Thuja plicata*	red-osier dogwood	*Cornus sericea*
Pacific willow	*Salix lasiandra*		
Forest Zone			
western red cedar	*Thuja plicata*	Nootka rose	*Rosa nutkana*
salmonberry	*Rubus spectabilis*	western hemlock	*Tsuga heterophylla*
Riparian Zone			
Red alder	*Alnus rubra*	red-osier dogwood	*Cornus sericea*
Sitka willow	Salix sitchensis	Sitka spruce	Picea sitchensis
western red cedar	*Thuja plicata*		

Goals, Objectives, and Standards of Success

The goal of the mitigation plan is to create a functional self-sustaining wetland system having similar structural and species diversity as the impacted areas along the project corridor and adjacent wetlands surrounding May Creek. The mitigated wetland is expected to provide food-chain support, wildlife habitat, flood flow de-synchronization, water quality, and sediment/nutrient detention. The surrounding forest zone will provide habitat and protect the site from human intrusion, noise, and glare from the highway.

Food chain support for wetland and other species will be increased as the wetland changes from a degraded pasture wetland to scrub-shrub. The wetland will provide greater food chain support than the existing vegetation community as the site changes from a system dominated by pasture grasses to a more complete system dominated by woody vegetation.

The mitigated wetland will consist of a forested/scrub-shrub wetland associated with May Creek. This vegetative system is expected to attract and support wildlife species such as passerines and predator species such as Great Blue Heron and raptors. The ecotone between the created wetland and the forest zone area is also expected to support species associated with this habitat area.

Flood flow de-synchronization and sediment detention will increase as the riparian zone vegetation density increases.

Objective #1: Create a scrub-shrub/forested wetland system that has vegetative structure and species diversity similar to that found in the natural systems within the surrounding area.

Performance Standards:
After three years:

1. Establish a scrub-shrub/forested wetland community of at least 1.09 ha (2.70 ac).
2. The wetland has greater than or equal to 75% areal cover of facultative or wetter plants.
3. The scrub-shrub/forested zone has greater than or equal to 25% areal cover of planted tree and shrub species as listed in Figure 5, or of native tree or shrub species through natural recruitment.

After five years:

1. **The wetland has greater than or equal to 80% areal cover of facultative or wetter plants.**
2. **The scrub-shrub/ forested zone has greater than or equal to 35% areal cover of planted tree and shrub species as listed in Table 5, or of native tree or shrub species through natural recruitment.**
3. **Non-native species will comprise less than 15% of the wetland vegetation.**

Objective #2:
A scrub-shrub/forest riparian zone should be created on the southwestern border of the wetland site.

Performance Standards:
After three years:

1. The riparian zone has greater than or equal to 75% areal cover overall of facultative or wetter plants.
2. The riparian zone has greater than or equal to 25% areal cover of planted tree and shrub species as listed in Figure 5, or of native tree or shrub species through natural recruitment.

After five years

1. **The riparian zone has greater than or equal to 80% areal cover of facultative or wetter plants.**
2. **The riparian zone has greater than or equal to 35% areal cover of planted tree and shrub species as listed in Table 5, or of native tree or shrub species through natural recruitment.**
3. The riparian zone width will average fifty feet as shown in the design plans (Fig 5).

Objective #3:
A forest zone will be created on the north and east border of the site.

Performance Standards:
After three years:

1. The forest zone has greater than or equal to 75% areal cover overall of facultative or wetter plants.
2. The forest zone has greater than or equal to 15% areal cover of planted tree and shrub species as listed in Figure 5, or of native tree or shrub species through natural recruitment.

After five years:

1. **The forest zone has greater than or equal to 80% areal cover of facultative or wetter plants.**
2. **The forest zone has greater than or equal to 25% areal cover of planted tree and shrub species as listed in Table 5, or of native tree or shrub species through natural recruitment.**
3. The forest zone width will average 50 feet as shown in the design plans (Figure 5).

Objective #4:
Increase in wildlife habitat.

Performance Standards:
After three years:

1. performance standards for Objective #1 apply
2. the ten habitat structures remain (see Figure 5).

After five years

1. **performance standards for Objective #1 apply.**
2. **a forested vegetation class and a scrub-shrub vegetation class will be identifiable, as determined by the presence of species listed in Figure 5, and/or the recruitment of native forest or scrub-shrub species.**

Contingency Plans

6 **The mitigation plan is designed to utilize and promote the growth of native vegetation. Noxious weeds, such as purple loosestrife or tansy will be eliminated within that growing season if found on the site. A weed control program will be implemented if more than 20% of the wetland cover is comprised of invasive exotic species.**

SR 900 May Valley SW Herbaceous Species List 2000

Species Name	Common Name	Status	Origin
Agrostis alba	redtop	FAC	Eur
Agrostis capillaris	colonial bentgrass	FAC	Eurasia
Agrostis sp.	bentgrass	---	
Alnus rubra	red alder	FAC	Native
Bromus sitchensis	Alaska brome	NL	Native
Carex stipata	sawbeak sedge	OBL	Native
Dactylis glomerata	orchard grass	FACU	Eur
Equisetum fluviatile	water horsetail	OBL	Native
Equisetum telmateia	giant horsetail	FACW	Native
Festuca arundinacea	tall fescue	FAC-	Eur
Festuca rubra	red fescue	FAC+	Native
Galium trifidum	small bedstraw	FACW+	Native
Galium triflorum	sweet-scent bedstraw	FACU	Native
Geranium robertianum	Robert geranium	NL	Native
Geum macrophyllum	large-leaf avens	FACW-	Native
Holcus lanatus	common velvet grass	FAC	Eur
Juncus effusus	soft rush	FACW	Native
Lolium multiflorum	Italian ryegrass	NL	Eur
Phalaris arundinacea	reed canarygrass	FACW	Nat & Intro
Poa sp.	bluegrasses	---	
Poa trivialis	rough bluegrass	FACW	Intro
Poaceae	grass family	---	
Polystichum munitum	sword fern	FACU	Native
Ranunculus repens	creeping butter-cup	FACW	Eur
Scirpus microcarpus	small-fruit bulrush	OBL	Native
Senecio jacobaea	tansy ragwort	FACU	Eur
Vicia sativa	common vetch	UPL	Intro
Polypodiaceae	Ferns	---	---

SR 900 May Valley SW Woody Species List 2000

Species Name	Common Name	Status	Origin
Cornus sericea	red-osier dogwood	FACW	Native
Fraxinus latifolia	Oregon ash	FACW	Native
Malus fusca	Pacific crabapple	FACW	Native
Physocarpus capitatus	Pacific ninebark	FACW-	Native
Picea sitchensis	Sitka spruce	FAC	Native
Populus balsamifera	black cottonwood	FAC	Native
Rosa nutkana	Nootka rose	FAC	Native
Rubus armeniacus	**Himalayan blackberry**	**FACU**	**Eur**
Rubus laciniatus	**evergreen blackberry**	**FACU+**	**Eur**
Rubus ursinus	California dewberry	FACU	Native
Salix lucida	Pacific willow	FACW+	Native
Salix sitchensis	Sitka willow	FACW	Native
Thuja plicata	western red cedar	FAC	Native

SR 900 May Valley NE, King County

The following report summarizes project activities completed by the Washington State Department of Transportation (WSDOT) Wetland Monitoring Program at the SR 900 May Valley NE wetland mitigation site in August 2000. Activities include cover surveys of woody and herbaceous vegetation.

Site Information
The May Valley mitigation sites were created as compensation for wetland impacts that occurred during widening and realignment of SR 900 at its junction with May Valley Road in King County. Wetland impacts from the project total 0.73 ha (1.81 ac), with mitigation provided by the May Valley SE and May Valley NW sites.

Site Name	SR 900 May Valley NE
Project Name	Junction, SE May Valley Road – SR 900
Location	Northeast corner of the intersection, King County
Township/Range/Section	T23N R6E S7
Monitoring Period	1996-2000
Year of Monitoring	5 of 5
Area of Project Impact	0.73 ha (1.81 ac)
Type of Mitigation	Wetland Enhancement and Upland Buffer Creation
Area of Mitigation	0.42 ha (1.03 ac)
Replacement Ratio	Wetland = 2:1 and 4:1 Upland = 5:1

Management and Sampling Objectives
Monitoring objectives for the May Valley NE mitigation site were developed from success standards described in the *Supplement to SR 900, SE May Valley Road Junction Final Wetland Mitigation Plan* (WSDOT 94). The complete text of the success standards for this project is listed in Appendix L. Success standards, management objectives, and sampling objectives addressed this year are presented below. Management objectives without a corresponding sampling objective are addressed in the results section.

Success Standard
The wetland has 50-75% areal cover by scrub-shrub/forested vegetation of facultative or wetter species.

Management Objective 1
Achieve 50% or greater aerial cover by facultative and wetter scrub-shrub and forest species in the wetland area at the SR 900 May Valley NE mitigation site in year 2000.

Sampling Objective 1
To be 80% confident the mean aerial cover estimate of scrub/shrub and forest species in the wetland area is within 20% of the true cover value.

Standard
Non-native species will comprise less than 15% of the wetland vegetation.

Management Objective 2
Maintain the cover of non-native woody species at less than 15% cover in the wetland area at the SR 900 May Valley NE mitigation site in year 2000.

Sampling Objective 2
To be 80% confident the mean aerial cover estimate of non-native woody species is within 20% of the true cover value.

Success Standard
Scrub-shrub and forested vegetation on-site will be as listed in Figure 6, or be at least the same number of native species through natural recruitment.

Management Objective 3
To identify the 13 native forested and scrub-shrub species as listed in Figure 6 of the mitigation plan, or an equal number of naturally occurring native forest and scrub-shrub species in the wetland area of the SR 900 May Valley NE mitigation site in year 2000. [1]

Success Standard
Aeral vegetative cover of the upland buffer is at least 90%.

Monitoring Objective 4
Achieve 90% aerial cover of herbaceous species in the upland buffer of the SR 900 May Valley NE mitigation site in year 2000.

Sampling Objective 4
To be 80% confident the mean aerial cover estimate of herbaceous species in the upland buffer is within 20% of the true cover value.

Success Standard
Habitat diversity will be maintained by the presence of at least three native scrub-shrub species which will comprise at least 75% of the% of vegetative cover.

Monitoring Objective 5
Achieve 75% combined cover of three native scrub-shrub species in the upland buffer on the SR 900 May Valley NE mitigation site in year 2000.

[1] Figure 6 contains a planting list from the *Supplement to SR 900, SE May Valley Road Junction Final Wetland Mitigation Plan* (WSDOT 95). It has been included in Appendix L.

Sampling Objective 5
To be 80% confident the combined mean aerial cover estimate of three native scrub-shrub species in the upland buffer is within 20% of the true cover value.

Success Standard
The mitigation plan is designed to utilize and promote the growth of native vegetation. Noxious weeds, such as purple loosestrife or tansy will be eliminated within that growing season of found on the site. A weed control program will be implemented if more than 20% of the wetland cover is comprised of invasive exotic species

Management Objective 6
Maintain the cover of invasive exotic species at less than 20% aerial cover on the SR 900 May Valley NE mitigation site between 1996 and 2000.

Sampling Objective 6
To be 80% confident the mean aerial cover estimate of invasive exotic species is within 20% of the true cover value.

Methods

A sampling macroplot (80m × 41m) was strategically positioned to include the upland buffer and wetland area at the May Valley NE mitigation site. Following a random start, 22 sampling transects were located along a baseline using a systematic random sampling method. Transects extended from the baseline at the northwest end of the site, crossed both the upland buffer and wetland area, and were terminated at the southwest end of the site. Both herbaceous and woody species cover data were collected along sampling transects.

Cover data for the woody species plant community were collected using the line-intercept method (Canfield 1941; Bonham 1989). All woody vegetation intercepting tape measures stretched along each sampling transect was identified and the length of the canopy intercept was recorded.

For the herbaceous community, the point intercept technique (Bonham 1989; Elzinga et al. 1998) was used to collect aerial cover data for plant species. Following a random start, point quadrats were systematically placed along sampling transects through both vegetative zones. At each point location, a rod was dropped vertically from above the tallest herbaceous vegetation. All plant species touched by the rod were recorded. If the rod touched no vascular plant species, the data was recorded as bare soil, non-vascular plant, or habitat structure.

The following sample size equation was used to determine the number of sample units required to meet the sampling objective.

$$n = \frac{(z)^2(s)^2}{(B)^2}$$

z = standard normal deviate
s = sample standard deviation
B = precision level[2]
n = unadjusted sample size

Results and Discussion

The mean aerial cover estimate of facultative and wetter native woody species in the wetland area was 67% (CI 0.90 ± 0.15). This value is within the confidence interval, indicating that the true value may meet the desired cover level.

The cover provided by non-native woody species has been successfully limited on this site (management objective two). Cover of *Rubus armeniacus* (Himalayan blackberry), the only non-native species identified in line intercept data records, was below 1%. A qualitative assessment confirmed that there were only trace amounts of non-native woody cover on site.

Observations report that there is marked structural and species diversity in the tree and shrub community. Each of the 13 native forested and scrub-shrub species listed in Figure 6 (Appendix L) of the mitigation plan (WSDOT 95) were identified on site, achieving management objective three.

A qualitative assessment for herbaceous cover in the upland buffer was 100%, excluding mulched areas around each planted tree or shrub, achieving management objective four.

The aerial cover of native woody species in the upland buffer was 44% (CI 0.80 ± 0.20), below the 75% cover requirement specified in management objective five. *Rosa nutkana (*Nootka rose) contributed the majority of this cover while *Rubus parviflorus (*western thimbleberry) and *Sambucus racemosa (*red elderberry) were also present. Although development has been slow, qualitative observations on site indicate that survival of planted tree and shrub material has been satisfactory in the upland buffer area. With time, the upland buffer should develop as intended without intervention. However, management activities are being considered by regional staff.

The aerial cover of invasive exotic species on site was 21% (CI 0.80 ± 0.20), placing the 20% threshold specified by management objective six within the confidence level for this data. *Phalaris arundinacea* (reed canarygrass) contributed nearly all of this cover, while *Cirsium vulgare* (bull thistle), *Geranium robertianum* (Robert geranium), *Lythrum salicaria* (purple loosestrife), and *Rubus armeniacus* (Himalayan blackberry) were also present at very low cover levels. Regional environmental staff are considering potential management activities.

[2] The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

Although the upland buffer has developed slower than intended and the cover of invasive exotic species approximates the threshold level of 20%, the May Valley NE mitigation site has developed exceptionally well in other respects. A forested/scrub shrub community will high species and structural diversity has developed in the wetland area satisfying the primary goals and objectives for the site.

Table 1. Table one shows the mean aerial cover estimate for facultative and wetter woody species in the wetland area (management objective 1). Management objective two was achieved.

Wetland Zone	FAC and Wetter Woody Species (Objective 1)	Non-Native Woody Species (Objective 2)
Total Aerial Cover	67%	<1%
Management Objective	75%	<15%

Table 2. Cover estimates show objective three has been achieved, and objective five was not achieved in the upland buffer.

Upland Buffer Zone	Herbaceous Species (Objective 4)	3 Native Woody Species (Objective 5)
Total Aerial Cover	100%	44%
Management Objective	90%	75%

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Appendix L

The following excerpt is from the *Junction, SE May Valley Road SR 900 Detailed Wetland MitigationPlan* (WSDOT 1995). The standards addressed this year are identified in **bold** font.

Figure 6 Plant Material List

Riparian Zone
Salix lasiandra
Salix sitchensis
Salix lasiandra
Thuja plicata
Scrub-Shrub/Forest Zone
Cornus sericea
Fraxinus latifolia
Oemleria cerasiformis
Physocarpus capitatus
Populus trichocarpa
Rubus spectabilis
Upland BufferZone
Rosa nutkana
Rubus parviflorus
Sambucus callicarpa

Goals

The enhancement area will consist of a forested/scrub-shrub wetland associated with May Creek. Wetland functions of food-chain support, wildlife habitat, flood attenuation, and sediment detention will be improved from existing conditions. The surrounding forest zone will provide habitat and protect the site from human intrusion, noise, and glare from the highway.

Objective 1:

Create a wetland system that has a vegetative structure and species diversity similar to that found in the natural systems within the surrounding area (see Clay-Poole 1944 for full description).

Performance Standards:

After three years:

1. The wetland has greater than or equal to 75% areal cover overall of facultative or wetter plants.
2. A forested/scrub-shrub wetland community of at least 0.73 ac will be established.
3. Scrub-shrub and forested vegetation on site will be as listed in Figure 6, or be at least the same number of native species through natural recruitment.

After five years:

1. **The wetland has 50-75% areal cover by scrub-shrub/forested vegetation of facultative or wetter species.**
2. **Non-native species will comprise less than 15% of the wetland vegetation.**
3. **Scrub-shrub and forested vegetation on-site will be as listed in Figure 6, or be at least the same number of native species through natural recruitment.**

Objective 2:
Increase in wildlife habitat.

Performance Standards:
After three years:

3. performance standards for Objective 1 apply
4. the five habitat structures remain (see Section 5).

After five years

3. **performance standards for Objective 1 apply.**
4. **a forested vegetation class and a scrub-shrub vegetation class will be identifiable, as determined by the presence of species listed in Figure 6, and/or the recruitment of native forest or scrub-shrub species.**

Objective 3:
Upland buffer will be improved over existing conditions by removing the private residence on site (currently located in what will become buffer area) and by the establishment of a scrub-shrub class beyond the current dominant cover of brambles.

Performance Standards:
After three years:

1. aeral vegetative cover of the upland buffer is at least 50%.
2. habitat diversity will be maintained by the presence of at least three native scrub-shrub species which will comprise at least 75% of the% of vegetative cover.

After five years

3. **aeral vegetative cover of the upland buffer is at least 90%.**
4. **habitat diversity will be maintained by the presence of at least three native scrub-shrub species which will comprise at least 75% of the% of vegetative cover.**

Contingency Plans (#4)

The mitigation plan is designed to utilize and promote the growth of native vegetation. Noxious weeds, such as purple loosestrife or tansy will be eliminated within that growing season if found on the site. A weed control program will be implemented if more than 20% of the wetland cover is comprised of invasive exotic species.

SR 900 May Valley North Herbaceous Plant List

Species Name	Common Name	Status	Origin
Agrostis capillaris	colonial bentgrass	FAC	Eurasia
Agrostis alba	redtop	FAC	Eur
Dactylis glomerata	orchard grass	FACU	Eur
Epilobium ciliatum	hairy willow-herb	FACW-	Native
Festuca arundinacea	tall fescue	FAC-	Eur
Equisetum telmateia	giant horsetail	FACW	Native
Festuca pratensis	meadow fescue	FACU+	Eur
Festuca rubra	red fescue	FAC+	Native
Festuca sp.	fescues	---	---
Geranium robertianum	Robert geranium	NL	Native
Geum sp.	avens	---	
Poaceae	grass family	---	
Holcus lanatus	common velvet grass	FAC	Eur
Juncus effusus	soft rush	FACW	Native
Lolium multiflorum	Italian ryegrass	NL	Eur
Lolium perenne	perennial ryegrass	FACU	Eur
Solanum dulcamara	climbing nightshade	FAC+	Eur
Phalaris arundinacea	reed canarygrass	FACW	Nat & Intro
Polystichum munitum	sword fern	FACU	Native
Poa trivialis	rough bluegrass	FACW	Intro
Poa sp.	bluegrasses	---	
Ranunculus repens	creeping butter-cup	FACW	Eur
Rumex salicifolius	willow dock	FACW	Native
Rubus ursinus	California dewberry	FACU	Native
Scirpus microcarpus	small-fruit bulrush	OBL	Native
Trifolium sp.	clover	---	
Trifolium repens	white clover	FAC	Eur

SR 900 May Valley North Tree and Shrub Plant List

Species Name	Common Name	Status	Origin
Alnus rubra	red alder	FAC	Native
Cornus sericea	red-osier dogwood	FACW	Native
Fraxinus latifolia	Oregon ash	FACW	Native
Malus fusca	Pacific crabapple	FACW	Native
Oemleria cerasiformis	Indian plum	FACU	Native
Physocarpus capitatus	Pacific ninebark	FACW-	Native
Populus balsamifera	black cottonwood	FAC	Native
Prunus sp.	plum, cherry	---	
Pseudotsuga menziesii	Douglas fir	FACU	Native
Rosa gymnocarpa	little wood rose	FACU	Native
Rosa nutkana	Nootka rose	FAC	Native
Rosa pisocarpa	peafruit rose	FAC	Native
Rosa sp.	Rose	---	
Rubus armeniacus	Himalayan blackberry	FACU	Eur
Rubus laciniatus	evergreen blackberry	FACU+	Eur
Rubus parviflorus	western thimbleberry	FAC-	Native
Rubus spectabilis	salmonberry	FAC+	Native
Salix lucida	Pacific willow	FACW+	Native
Salix sp.	willows	---	
Sambucus racemosa	red elderberry	FACU	Native
Thuja plicata	western red cedar	FAC	Native

Glossary of Terms

Abundance (total) – the total number of individuals, cover, frequency of occurrence, volume, or biomass of a species, or group of species, within a given area.

Accuracy – the closeness of a measured or computed value to its true value.

Adaptive management – the process of linking ecological management within a learning framework.

Aerial cover - is the amount of ground covered by vegetation of a particular species or suite of species when viewed from above. Aerial cover is generally expressed as a percentage. This is typically obtained from herbaceous plot, point intercept, or line intercept data.

Areal estimates - are made using the mapped boundary of a feature as viewed from above. Areal estimates are a measure of area recorded as a number from 0 to 100, and not as a fraction or percent (Hruby et al. 1999). Compare this to the definition of percent cover.

Aquatic vegetation - includes submerged rooted (includes *Elodea*, *Characeae*, *Myriophyllum*) or floating non-rooted aquatic plants (includes *Lemna, Azolla, Wolfia*). For compliance purposes, these plants are not included in cover estimates.[1]

Bare ground - an area that can support, but does not presently support vascular vegetation (for compliance purposes, bare ground may include areas covered by cryptogams).

Benthic community - life in or on the sediments of a body of water.

Biological monitoring – the acquisition of information to assess the status and trend in status of the structure and functioning of biological populations and communities, and their habitat, and larger-scale ecological systems over time for the purpose of assessing and directing management activities (Elzinga et al. 1998).

Biological population – all of the individuals of one or more species within a prescribed area at a particular time.

Confidence interval (CI) – is an estimate of precision around a sample mean. A confidence interval includes confidence level and confidence interval half-width.

[1] For compliance purposes, vascular floating-leaved plants are included in cover estimates (e.g., *Nuphar, Potamogeton*).

Glossary (continued)

Canopy cover - the coverage of foliage canopy (herbaceous or woody species) per unit ground area.

Community - a group of populations of species living together in a given place and time.

Cryptogam - any of the *Cryptogamia*, an old primary division of plants comprising those without true flowers and seeds including ferns, mosses, and thallophytes (algae, fungi, and lichen).

Density – the number of individuals, stems, or other counting unit per unit area.

Ecotone - the boundary or transitional zone between adjacent communities.

Emergent plants - erect, rooted, herbaceous angiosperms that may be temporarily to permanently flooded at their base but do not tolerate prolonged inundation of the entire plant.

Floating plant - a non-anchored plant that floats freely in the water or on the water surface.

Floating-leaved plant - a rooted, herbaceous hydrophyte with some leaves floating on the water surface.

Herbaceous - with characteristics of an herb; an annual, biennial, or perennial plant that is leaflike in color or texture, or not woody.

Herbaceous cover - is the estimated aerial cover of herbaceous vegetation on a mitigation site; generally expressed as a percentage. Specifically, it is the proportion of ground covered by the herbaceous layer relative to the proportion of bare ground.

Hydric soils - soils formed under the conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register 1994).

Line transect – a transect for which the sampling unit is, theoretically, a line with no width.

Macroplot – usually refers to a relatively large sampling area in which subsampling will be conducted, often using quadrats and/or transects.

Management objective – a clear description of a measurable standard, desired state, threshold value, amount of change, or trend that you are trying to achieve for a particular population or habitat characteristic (Elzinga et al. 1998).

Glossary (continued)

Mud flat - a level landform composed of unconsolidated sediments. A mud flat may be irregularly shaped or elongate and continuous with the shore, whereas bars are generally elongate, parallel to the shore, and separated from the shore by water (Cowardin et al. 1979).

Open water - an area intended to be non-vegetated and permanently inundated as described in the site mitigation or planting plan.

Plot - a general term applied to any size of a circumscribed sampling unit for vegetation.

Point frame – is a linear, square, or rectangular quadrat that consists of a number of points used to collect vegetation data.

Point quadrat (points) – is a plot with a very small area, a single point, used to collect vegetation data. The point quadrat is theoretically dimensionless.

Population (biological) – all individuals of one or more species within a specific area at a particular time.

Population (statistical) - the complete set of individual objects (sampling units) about which you want to make inferences.

Precision – the closeness of repeated measurements of the same quantity.

Quadrat - an area delimited for sampling flora or fauna; the sampling frame itself.

Random sampling – sampling units drawn randomly from the population of interest.

Relative abundance (birds) – the number of individuals per unit of sampling effort.

Restricted random sampling – a sampling method that divides the population of interest into equal-sized segments. In each segment, a single sampling unit is randomly positioned. Sampling units are then analyzed as if they were part of a simple random sample.

Sample – a subset of the total possible number of sampling units in a statistical population.

Sample standard deviation – a value indicating how similar each individual observation is to the sample mean.

Sample statistics – are descriptive measures that are estimates of population parameters.

Glossary (continued)

Sampling – the act or process of selecting a part of something with the intent of showing the quality, style, or nature of the whole.

Sampling objective – a clearly articulated goal for the measurement of an ecological condition or change value (Elzinga et al. 1998).

Sampling units – the individual objects that collectively make up a statistical population, e.g., an individual plant, quadrats (plots), points, or transects (lines).

Standard deviation (SD) – a measure of how similar each individual observation is to the overall mean value.

Shrub - a woody plant which at maturity is usually less than 6m (20 feet) tall and generally exhibits several erect, spreading, or prostrate stems and has a bushy appearance (Cowardin et al. 1979). The species categories in this report follow Cooke (1997).

Species richness (birds) - the total number of bird species observed on a site.

Species richness (plant) - is the total number of species recorded on a site (herbaceous and woody).

Structures - any structure that is not expected to support vegetation in the short-term (during the monitoring period). These structures may include habitat structures, rocks, and other artifacts.

Systematic Random Sampling – the regular placement of quadrats, points, or lines along a sampling transect following a random start.

Transect - a line or narrow belt to survey the distributions or abundance of organisms across an area.

Tree - a woody plant that at maturity is usually 6m (20 feet) or more in height and generally has a single trunk, unbranched for 1m or more above ground, and more or less definite crown (Cowardin et al. 1979). The species categories in this report follow Cooke, 1997.

Vegetation structure - the physical or structural description of the plant life, e.g. the relative biomass (cover) in canopy layers; generally independent of particular species composition.

Wetland-dependent species (birds) - restricted in temporal or spatial distribution to wetlands based on an intrinsic feature or features of the environment (Finch, 1989).

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